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A NEW STATE ASSOCIATION.

We note with pleasure the emergence into the field of united work for a common good, of the Empire State Gas & Electric Association. Its first annual meeting, held this week in New York City, was well attended, and the interest shown, as well as the new enrollments, indicated that the new body will enjoy general support and have plenty of work cut out for it, whether for defence or for progress. The gas and electric interests will now have an organization that can do much for them, and one which co-operating with the new State Commission should be able to do much in securing a better comprehension on the part of the public of the conscientious manner in which the great majority of the companies are seeking to perform their duties in their respective communities, as public utility corporations. Presently, the tide of abuse and contumely with which corporations are now indiscriminately overwhelmed will roll back, and sanity will reassert itself; but it will do so more quickly with such organizations united to stamp out falsehood and to spread the truth. From the economic and industrial standpoints also, quite aside from the aspects of politico-sociology, these associations have much to do, and the opportunity opens for useful work on every hand. The officers who have brought this young body up to its present proportions and prosperity in so short a period are to heartily congratulated. In a general way, it is interesting to observe that the movement toward the organization of these "territorial" bodies has proceeded apace of late years. It is a good thing, especially as the point has been recognized that their strength lies in national organizations and not in building up a rival body. This has been very clearly shown in the gas field, where in fact a merging of national and sub-national bodies into a new solidified organization has recently been witnessed. When the national body does its work the State and territorial bodies will stand by it, and all will be benefitted. When there is central weakness, the minor organizations are often forced to take up work and duties for which they are not adequately equipped.

NIAGARA IN BUFFALO.

The transmission of power from Niagara Falls to Buffalo is an instructive matter in many particulars. It is in the first place an excellent exhibit of what hydraulic power can do in competition even with very cheap coal. It also gives an excellent idea of the extent to which a modern city can rely year in and year out upon a distant source of power. The work in Buffalo has grown up so gradually that no revolutionary changes have been made, and the aggregated plant has those peculiarities of service that are typical of most of the larger American cities. The strange mixture of direct-current with 60 and 25-cycle alternating-current is a curious example of the persistence of habit even in a growing art. Twenty years hence it will seem a wonderful exhibition of futile shortsightedness on the part of very worthy pioneers. By that time, we hope, one kind of current or the other will have acquired a settled supremacy, or at least methods of changing from one to the other without absurd complications will have been discovered. A very interesting feature of the Buffalo situation is the attempt at using 25 cycles for lighting upon a somewhat large scale. If one is going in for 25-cycle lighting it would be better to revert to lamps of larger candle-power or less voltage, or to turn to Nernst lamps, of which the glowers have enough thermal stability to prevent flickering. The 25-cycle experiment is interesting, however, and a

considerable relief so long as a genial public can be persuaded to take kindly to it.

City Arc Lighting.

It is interesting and important for central station managers and electrical engineers in general to note that the city of London—the small inner core of the great world metropolis—has reverted to the use of gas for its street lighting. Such a "throwing back" in a period when the arc lamp has universally triumphed as the best medium to employ for this work is susceptible of various explanations, and we observe that the committee in charge offers sundry grounds of justification. It is amusing at this late day to learn that arc lighting had proved a complete failure. The committee reported that incandescent gas lighting was in general and growing use in Paris, Berlin, Vienna and other important Continental towns. The difficulty about arc lighting, apart from its cost, is the unequal distribution and diffusion of the light—patches of bright light and dark shadows alternating in areas so lit. In contrast to gas, also, arc lamps, it is asserted, have little fog-penetrating power. It was considered, too, that the system of lighting a street by large units of light placed on high standards was far from economical. Light is wanted mainly on and about the pavement level, not on the house tops, and as the intensity of light varies inversely with the square of its distance from the object to be lighted, the most scientific way of illuminating a street would seem to be not to "sky" the source of light, but to use medium units on columns of moderate height at short intervals. Thus far the committee. It is asserted that the change has given twice as much light in candle-power, at a saving, apparently, of about $1,500 a year.

We have no reflection or criticism to offer upon our London friends in permitting this to happen, but it seems to us that the general power supply scheme of the past year has its warrant, to say the least, in such an incident, and that in a great city where fifty or sixty individual authorities have lighting powers, gas might well compete with electricity peddled out in a retail way. We have never been impressed with the value or high efficiency of the arc lighting in the city of London, but to our eye it has certainly been better than any gas lighting there. So far as we are aware, the general gain of electric lighting in the city of London and every other part of the metropolis is marked. It could hardly be otherwise in a modern city rising in the scale of comfort and convenience..

Still, there is food for thought in the occurrence, and a stimulus to the improvement of lighting methods hand in hand with cheapening of the current. We know of one city in America—Lowell, Mass.—that has again taken gas altogether for its street lighting, under circumstances of a rather peculiar character. It is a curious fact, we believe, that of late years, owing to the tremendous growth of their indoor load—light, power and heat—many central station managers have become indifferent to street lighting contracts, once the backbone of their business. But while the burden of political fights for the street lighting may have seemed onerous, it is after all a pity to neglect any item of the income, and it is the duty of the central station manager to get all the street lighting he can, if the rates are fair.

Dynamo Heating Time Constants.

An important problem connected with the determination of the performance of dynamo-electric machinery is that of ascertaining the maximum temperature rise for a certain load, and the rate at which the temperature varies. In designing a machine for a specific duty, very little trouble is encountered in obtaining the desired characteristics with reference to the efficiency and the general electrical behavior, since the theory of such characteristics is well known, and the constants involved in the formulas expressing the theory can easily be ascertained from experimental observations on completed machines. Although the determining factor in placing a capacity rating on a certain design of machine is the allowable temperature rise rather than the electrical characteristics, it is to be noted that only recently has the importance of this fact been fully appreciated by the writers on the design of electrical machinery. It is a remarkable fact that the typical treatise on design gave most elaborate discussions on the electrical characteristics of the machine, but the only reference to the effect of temperature on the capacity of the machine was summed up in the statement that a certain superficial area should be allowed for each watt of power lost within the machine. In few cases indeed was any mention made of the fact that the volume of the material in the machine affects the rate of increase of temperature, and that for overloads of short duration both the volume of the material and its superficial area must be considered.

The facts connected with the heating of electrical machinery are treated in an interesting and instructive manner by Mr. A. Press in an article which appeared on page 735 of our last issue. The article deals specifically with the rate of change of temperature when a machine is operating under a certain load. The writer assumes that with a certain superficial area and under constant cooling conditions, the final temperature rise of the machine after infinite time will vary directly with the watts lost within the machine. In order to ascertain the rate at which the temperature of the machine will tend to increase to the maximum value, the assumption is made that the rate of increase in temperature when the machine is first placed in operation at the chosen load is the same as the rate of decrease in temperature when the machine is allowed to cool freely from the maximum temperature due to that load. The well known law of cooling, which states that the instantaneous rate of transfer of energy from the body is proportional to its exposed area and the difference between the temperature of the body and that of the surrounding medium, is applied directly. When a body is heated to a certain temperature above the surrounding medium it is evident that the amount of energy contained within it by reason of its temperature rise is equal to the product of its heat capacity and the range of temperature, and that the rate of cooling at each instant will vary directly as the exposed area and inversely as the heat capacity. The article by Mr. Press indicates the method by which this law may be applied to commercial dynamo-electric machinery, and shows the advantage of specifying as the "heating time constant" of the machine the time which would be required for the machine to reach the final maximum temperature if all the losses were retained within the machine without any dissipation during this time. It is clearly shown that the maximum temperature rise depends directly upon the area exposed to cooling, and that the rate of increase of temperature depends directly on the maximum temperature rise and inversely on the volume of the machine.

Commercial Photometry.

We publish in the Digest this week some account of a so-called watt-photometer designed to tell all about an incandescent lamp at one simple reading. It seems very ingenious and will doubtless strike the fancy of many persons who long for short cuts to exact knowledge. There have been similar instruments toted around in this country by lamp salesmen, and we have been yearly expecting a pocket photometer reading by vernier to hundredths of a candle-power. Now, we do not wish to be understood as depreciating the

enthusiasm that produces such instruments, but merely to call attention to the fact that consistent readings are no evidence of precision in a photometer, any more than in an aneroid barometer or any other instrument in which exactness has been sacrificed to portability. The wonder is that such devices at any time come within shrieking distance of precision. In the matter of photometry we wish that every man who talks glibly about horizontal, spherical, hemispherical and other kinds of candle-power were compelled as a preliminary to put in about six months hard work in a first-class photometer room fitted with all the latest devices. The first effect of really conscientious work of this kind is a chronic tendency to unseemly mirth when small fractions of candle-power are defined, and a disposition to slowly lower an eyelid when standards are mentioned. An experienced observer can do wonderfully consistent work, and even a pair of observers working side by side will fall into a sort of automatic agreement, but if they work apart and with different instruments the trouble begins.

The possible errors in photometric absolute determinations are numerous and great, so great that they cannot be eliminated even in a permanent photometer room with any really satisfactory degree of certainty; and it is not too much to say that however ingeniously a portable photometer may be planned, its usefulness is necessarily very limited by reason of errors that cannot certainly be eliminated. A single observer familiar with his instrument can get useful relative results, and that is about the end of the matter. If one could get even this amount of satisfaction in measuring illumination it would be highly convenient, but the closer one comes to the physiological side of light, the larger the personal errors become. Their elimination from ordinary photometry is a problem of the gravest character deserving more attention than has yet been paid it. Even a careful observer not only has his own errors in setting the screen, but these are liable to slow variation over a pretty wide range. He may make a long string of readings with variations of only one or two per cent, and then without apparent reason get the next day an equally consistent set, perhaps five per cent different. Or he will fall into unconscious habits of setting that prove a source of large errors when the conditions are changed, as for instance by the substitution of a different screen. These subconscious personal errors are most troublesome, though least apparent in apparatus of relatively fixed character. Hence these strictures on instruments in themselves extremely well planned from a purely physical standpoint. The amount annually spent in this country alone for artificial lighting is hard to determine with any precision, but it is pretty certainly in excess of $150,000,000. Considering the magnitude of the expenditure, the facilities for measuring the commodity purchased are singularly meagre. They deserve improvement and ought to be persistently studied until improvements are made. But improvements can be made only by thorough investigation of the physiological factors of the problem which determine the limits of the attainable precision.

ALTERNATING-CURRENT GALVANOMETERS.

The wonderful sensitiveness and convenience of the D'Arsonval type of galvanometer is due to the fact that the force exerted upon an element of wire carrying a current in a magnetic field is proportional to the product of the current and the field intensity, so that a feeble current in a powerful field produces a fairly considerable, and not merely a feeble, mechanical force. The magnetic field is permanent and costs nothing to maintain. Unfortunately the D'Arsonval permanent magnet instrument fails to respond to alternating currents, the momentum exerted on the coil by a current in one alternation being annulled by that exerted in the next and reversed alternation. Evidently the magnetic field must alternate isochronously with the alternations of current in the coil in order to maintain a steady torque upon the coil. This naturally leads up to the types of alternating-current dynamometers in which the alternating-current in the stationary coil produces the alternating field, within which the current through the movable coil can set up a rotative effort or torque.

The alternating-current dynamometer is, therefore, a form of instrument bearing resemblance to the D'Arsonval direct-current galvanometer, but substituting an alternating electromagnetic field for the permanent-magnet field. Unfortunately, however, this alternating current field has a magnetic circuit entirely of air, so that the magnetic field is not only proportional to the current, but is also extremely feeble by comparison with that which a permanent magnet can produce. Consequently, an electrodynamometer is not only complicated by an uneven scale of deflections; but the sensitiveness of the apparatus is exceedingly small by comparison with that of a D'Arsonval direct-current instrument. Of recent years attempts have been made to increase the sensibility of the alternating-current galvanometer and to bring it more nearly on a parity with the direct-current D'Arsonval galvanometer, by employing a laminated iron magnetic circuit for the stationary element, so as to produce a powerful alternating magnetic field in the airspace through which the movable coil may swing. It was soon found, however, that the movable coil acted like the secondary winding of a transformer, and that as soon as its circuit was closed externally it endeavored to set itself in such a direction as would satisfy the forces due to the current induced by the alternating field. It would seem that there is a fair prospect of minimizing satisfactorily the difficulty due to locally induced currents in the coil, and thus of enabling the alternating-current D'Arsonval instrument to be used with a satisfactory degree of sensibility, although we are not likely to attain either to the sensibility or to the convenience of the direct-current D'Arsonval type.

A recent number of the *Physical Review* contains an article by Mr. E. M. Terry upon a measurement of the variation of capacity in condensers with temperature by means of an alternating-current galvanometer. It has been well known for many years that condensers have a small negative temperature coefficient, or, that their capacity diminished slightly with increase of temperature; but the measurement has perhaps never been made before by an alternating-current galvanometer to such a degree of precision as the article indicates. The fact that this high degree of precision was attained speaks well for the alternating-current galvanometer method. The details of the control of the instrument are of much interest. The origin of the temperature change of capacity in a condenser has not been cleared up, so far as we are aware. Some have suggested that it was a direct consequence of expansion of the dielectric, whereby it became slightly increased in thickness with rise of temperature, and with a proportional loss of capacity. But if the dielectric film increases in thickness, it will also increase in length and breadth. The increase in capacity due to swelling in two dimensions ought, according to this reasoning, to be double the diminution in capacity due to swelling in the third dimension, so that one might suppose the capacity would slightly increase with expansion of the dielectric due to rise of temperature, instead of diminishing, as is apparently always observed. Perhaps the cause of the phenomenon is more deeply seated. It is earnestly to be hoped that such development may be made in the construction and use of alternating-current galvanometers as may fit them for sensibility under wide ranges of frequency and current strength. This would fill a wide and widespread deficiency.

Accident Swindling in the Electrical Field.

An organization to be called The Alliance Against Accident Frauds has been formed in New York City, at a meeting held last week. There were present at the meeting representatives of corporations from Boston to Chicago, and letters were received from many others saying that they would join the alliance. The objects of the alliance are:

To protect and defend its members again fraudulent claims and prosecute all persons engaged in presenting or promoting such claims; to collect and disseminate information to its members concerning fake claimants, shyster lawyers and unprincipled physicians, ambulance chasers, false witnesses, and others engaged in such practices and methods; to insist upon fair dealing with honest claimants and generally to impress upon the public the principles for which the alliance stands.

The companies represented were the United States Casualty Company, General Accident Corporation, Philadelphia Casualty Company, Great Eastern Casualty Company, New York City Street Railway Company, United Railways and Electric Company of Baltimore, Chicago and Northwestern Railway, New York Central and Hudson River Railway, Boston Elevated Railway, Washington (D. C.) Railways and Electric Company, Delaware, Lackawanna & Western, Hudson River Day Line, Travelers' Insurance Company of Hartford, Philadelphia Rapid Transit Company, Interborough Railway Company, Casualty Company of America, Little & Co., printers, and the Fuller Construction Company.

In the discussion of the plan and scope of the new alliance it was said that its mere existence would frighten off many persons who otherwise might bring fraudulent suits. It will be part of the plan to inform stockholders and policy holders in every corporation in the alliance of every case which is to be fought and the reason for contesting it. By this wide publicity it is thought that fraud will be made additionally difficult and dangerous.

It was said at the meeting that the alliance will do quite as much work to see that honest demands are promptly settled as it will to detect swindlers. With fraudulent demands out of the way, it was said, the railways and accident companies could give more time to genuine cases and settle them more promptly.

An effort is also to be made to have passed in every State laws similar to those passed by the Maryland Legislature against so-called ambulance chasers and dishonest physicians. At the meeting of the American Bar Association at Narraganett last summer the question of barratry was taken up, and that organization said it would co-operate with any association that would labor to put down the practice. A committee was appointed to confer further with the American Bar Association and with the American Medical Association on the subject. The following officers were chosen: President, Robert B. Armstrong, president of the Casualty Company of America; first vice-president, James R. Pratt, of the United Railways and Electric Company of Baltimore; second vice-president, R. C. Richards, of the Chicago and Northwestern; secretary-treasurer, Chauncey S. S. Miller. The first annual meeting will be held January 19.

Electric Lighting Development at Baltimore, Md.

The Eastern Electric Construction Company has lately put a new and competitive central station plant in operation at Baltimore, Md., with regard to which a few facts are appended.

The generating station is of steel and brick construction, situated near the mouth of the Patapsco River, with a siding from both the B. & O. and W. M. R. R. There is also provision for unloading barges, so that coal can be obtained from three sources. There is a coal conveyor installed, motor driven, to convey the coal to the bunkers situated in the top of the boiler room. The boiler equipment consists of two batteries of four Stirling boilers each,equipped with Roney mechanical stokers. In the engine room are installed two 2,000-kw Westinghouse turbo-generator outfits, 6,600 volts, 7,200 alt., three-phase. The condensers are situated directly underneath the turbines, and are arranged for cross connection, so that either condenser can be used with either turbine. Water for the condensers is obtained by duplicate sets of engine driven centrifugal pumps, which circulate the water from the bay. Duplicate steam driven vacuum pumps are also installed.

There are two exciters, one 75-kw, 225-volt Westinghouse motor-generator set, and one 100-kw engine driven unit. In addition to this, there is a storage battery designed to float on the exciter bus-bars, as an insurance against shutdown. The control apparatus, all Westinghouse, is excellently designed and the best of its type. The bus-bars are mounted in concrete structures on the engine floor and are in duplicate. The type "C" oil switches are mounted directly above, on the first gallery, as are also the exciter switchboard, the control pedestals and instrument posts, and the feeder control panels. Either generator can be thrown on either bus, as can be any feeder also. All oil switches are equipped with knife switches, so that each oil switch can be isolated. Motor-driven field rheostats and electrically operated field switches are installed on the second gallery.

The sub-station is supplied with three motor-generator sets consisting of a 1,400-hp induction motor and a 1,000 kw, direct-current, 250-volt, three-wire generator. The switchboard equipment, installed on the main floor, consists of four panels for the control of four incoming 6,600-volt feeders, four panels for the control of four 1,400-hp induction motors and four panels for the control of banks of three 250-kw, 6,600-2,200-volt transformers. The high-tension bus-bar structures are on the first gallery and are in general, similar to those at the main station, but include also the oil switches, which are type "E." The high-tension bus-bars are in duplicate and so arranged that any feeder or any circuit can be thrown on either bus.

The direct-current switchboard consists of four generator panels, a starting panel, three positive and three negative feeder panels and two blank panels. The bus-bars are in triplicate, and the board is so arranged that any machine or any feeder can be thrown on any bus. The starting panel controls the direct-current end of a 125-kw motor-generator set, supplied through three 65-kw oil-insulated, self-cooling lowering transformers. The large motor-generator sets are started by using the generator as a motor, supplied from the 125-kw motor-generator set, and the induction motor is thrown in when up to speed.

The banks of 250-kw, 6,600-2,200-volt transformers are used for supplying the outlying districts, and are controlled on their low-tension side by two transformer panels. The 2,200-volt board is equipped with two buses, to either of which the feeders can be connected. One phase of each feeder which supplies lighting, is equipped with type "F" compensators and regulating transformers, so that voltage can be maintained constant. Power will be supplied also from the same feeder.

A Year's Figures of the Subway.

The subway system of the Interborough Railway Company went into operation October 28, 1904, so that New York City has had just one year of underground electric railroad experience. The resulting data are of great interest. It has carried no fewer than 106,000,000 passengers, or an average of 300,000 a day in spite of many unforeseen obstacles and difficulties, such as flooding by broken water mains, and one very vicious but unsuccessful strike. General Manager Hedley says: "For several months the operation of the Subway was hampered by incomplete terminals and the newness of the system, so that the train service could not be run up to the maximum. Since the completion of the lines to South Ferry conditions have been much improved. Five hundred of the first cars purchased have passed through the shops; the end doors have been made considerably larger, and the bulkheads inside the cars have been removed. This has been the subject of favorable comment on the part of the passengers and has led to a marked difference in the time it takes to embark and disembark."

A plan to lengthen the local platforms so that they can accommodate seven cars instead of five is now under consideration. It is likely that work on the platforms will begin in the next month or two. The line to Brooklyn is in such condition that next year will see direct rail connection between that borough and the financial, commercial, shopping, amusement and residential districts of Manhattan.

Based on the number of fares paid, the stations rank in importance as follows: Brooklyn Bridge, Grand Central, Fourteenth Street, Fulton Street and Times Square. Times Square, the heart of the town, is far ahead of all other local stations. Five million persons, a number exceeding by half a million the estimated popula-

tion of New York City, boarded Subway trains there during the year. Supposing that just as many got off at Times Square 10,000,000 persons have passed through the station since October 27, 1904.

Eighteen million fares were paid at the Brooklyn Bridge, 10,000,000 at Grand Central, and nearly 7,000,000 at Fulton Street. The average number of passengers carried in the Subway every day was about 300,000. The estimated number of passengers on all the elevated lines for the same period is 261,666,686, an average of 716,895 a day. A fair estimate of the number of passengers carried by both Subway and elevated is 1,000,000 a day.

Only part of the Subway opened a year ago. Since then the Lenox Avenue branch to West Farms, the section from the Brooklyn Bridge down Broadway to South Ferry, and a mile stretch north of 135th Street, under Broadway, have been opened. The Interborough Company expects to run trains under Fort George and over the long viaduct to the Ship Canal by January 1. The Brooklyn branch will be opened next year.

Lamp Cluster Litigation.

On October 31 Judge Holt of the United States Circuit Court, sitting in New York, handed down a decision in a case involving the patents of Rueben B. Benjamin and John H. Dale on that form of lamp cluster arrangement which involves the use of only two wires, these wires making connection with two plates insulated from each other, which form integral lamp sockets. When the lamp is screwed in place it is in electrical contact with one side of the circuit through one of the plates and with the other side of the circuit through the second plate, against which the base of the lamp butts. The attorneys in the suit were Messrs. W. Clyde Jones, Keene H. Addington and Robert Louis Ames for Benjamin, and William M. Stockbridge, of Rosenbaum & Stockbridge, for Dale.

The decision upheld the validity of the Benjamin patents, but declared that these patents were not infringed by the Dale patent in suit. The court criticised the manner in which the Benjamin patents were loaded up with claims, one of the patents in suit containing 46 and the other 17 claims, making 63 in all. Many of these claims were declared to be substantially identical and the excessive number served no useful purpose and simply made burdensome the investigation of the claims. The court also stated that it could see no essential distinction between the two Benjamin patents in the suit. The complainant's counsel had stipulated to rely on only 17 claims of the first patent and 9 claims of the second patent, making 26 claims in all, but the court stated this number might have been further restricted without sacrificing any real rights of the complainant.

The court held that it could not see any substantial and essential electrical distinction between the Dale patent and the two Benjamin patents, but it could also see no substantial electrical distinction between these patents and a prior English patent to Broughan and an American patent to Weeks. Dale when he applied for his patent had the same right that Benjamin had to use the electrical devices shown in the prior patents mentioned. Benjamin produced by mechanical invention a wireless cluster of electric lights commercially superior to anything which had preceded it, and Dale had the same right to do the same thing, provided he did not infringe the Benjamin patents. In conclusion, Judge Holt stated that while he thinks it is a close question, he considers that the Dale patent involves sufficient mechanical invention distinct from the Benjamin patents to make it valid.

The Submarine Cable Situation in Alaska.

It is interesting to note that in his annual report Major W. A. Glassford, chief signal officer of the Department of the Columbia, who has charge of the entire cable and land telegraph system of Alaska, strongly recommends that the earnings of that telegraph service should be applied entirely to extensions and improvements of the system and to the laying of additional cables. This recommendation is heartily endorsed by Gen. Constant Williams, in command of the department, and it is altogether likely that it will likewise receive the endorsement of Gen. Greely, chief of the Signal Service.

Major Glassford was interviewed recently as to the submarine cable situation in Alaska and made some important statements that bear very intimately on wireless telegraph problems. He said: "One of the claims made in behalf of the wireless service was its adaptability to that section, because it would span over the physical difficulties encountered by the present land wires. In support of this claim the name of Capt. Leonard D. Wildman, Signal Corps, who installed the system between St. Michael and Nome, was used in such a way as to reflect upon the Signal Corps for not being in advance of modern progress in transmission of information.

"The Signal Corps is to-day operating the longest successful wireless system in the world between St. Michael and Safety Harbor, a distance of 107 miles. This plant was evolved and installed by the Signal Corps, and would naturally meet with any improvements or extensions, if such were possible. The mere fact that the chief signal officer of the army, after a personal visit to Alaska last summer, did not recommend the installation of the wireless plant demanded by the Alaskan papers shows that he found such extensions or improvements were not possible. On the contrary, an extension of the cable and land lines will doubtless be recommended. It may also be added that a commercial company has already failed to make possible communication through a chain of stations, which it undertook some two years ago in Alaska. The present installation between St. Michael and Safety Harbor is an outgrowth of the experience derived from the company in the failure to establish a chain of stations.

"It has been shown that a single stretch in wireless communication is quite possible, but a chain of them has not so far been accomplished. Even though the wireless installation of the Signal Corps might be extended 107 miles or more overland there would be objections, and possibly insurmountable difficulties in establishing a chain over so long a distance from St. Michael to Valdez, which in a straight line is between 500 and 600 miles, but with a chain of stations would be in the neighborhood of 1,000 miles.

"There has so far not been discovered any means by which a message can be sent and one be received at the same station at the same time. This difficulty or impossibility may be illustrated by supposing that a chain of six stations were established between Nome and Valdez via St. Michael, stations on the Yukon and Tanana and over the mountainous country to the headwaters of the Tanana, covering the present route of the telegraph line. If a number of messages were handed in at Nome at 8 o'clock in the morning to be transmitted over this line, the first relay would be at St. Michael, and the operator there would have to wait until the last of the whole number of messages were received before the first one could be forwarded to the second station in the chain.

"Supposing that an hour's work was over at Nome, it would therefore be 9 o'clock before St. Michael could commence to send. The next station would in turn send to the third station at 10 o'clock, and the third station would send to the fourth station at 11 o'clock, and the fourth station would send to the fifth station at 12 o'clock, and so on, so that it will readily be seen that Valdez would complete the reception of these messages, commenced five hours earlier at Nome, at about 1 o'clock in the afternoon. Valdez would forward them over the cable to Seattle as they were received. This would be the quickest possible time that the messages could be transmitted. In the meantime, by delay of an hour, these twenty or thirty messages might be sent from Valdez to Nome, the extra hour being required for the delay at the crossing. If messages were handed in at an intermediate station in the meantime, the time of transmission would be increased by an hour or so for every few messages.

"It must therefore be clear that, even though great improvements have been made in the wireless telegraph, it could not handle the volume of business that would be given to it as is now transmitted by the telegraph. In addition to this fact, there would be six telegraph stations in all Alaska, as against forty-two at present; and if the stations, were put, say 200 miles apart, which is at present the maximum limit of wireless telegraphy as demonstrated for practicable business transmission, there would be only a few, say five or six, telegraph stations in all Alaska, and it can readily be seen that some of the present important stations must be left out entirely. If they were to divide this disance on a basis of 200 miles, Fairbanks would be left out."

A Gift from Italian Electrical Engineers.

Another gift from the other side of the Atlantic has been received by the American Institute of Electrical Engineers, as a souvenir of the hospitalities of 1904. A pleasant incident at the 200th meeting of the Institute, held in New York City, October 27, was the exhibition to the 300 members in attendance, of the silver tablet presented to the Institute by the Associazone Elettrotecnica Italiana, as a testimonial in recognition of the courtesies extended to the members of the Association on the occasion

ITALIAN TESTIMONIAL TO THE A. I. E. E.

of their American tour during August and September last year..

The tablet is an artistic silver casting, mounted on a marble slab, the design embodying medallion portraits of Volta and Franklin, and an inscription in Latin, of which the following is a literal translation:

"By this Testimonial, the Italian colleagues place on record, for all time, their reception in gracious and generous hospitality, by their American colleagues, during the months of August and September, in the year 1904; may it be of good augury. Rome, the 31st day of the month of December, in the year 1904."

This tablet will be placed in a prominent position in the Institute headquarters in the Union Engineering Building, now in process of construction.

Underground Wires for Hartford, Conn.

The subject of underground wires is being considered at Hartford, Conn., and Mr. F. L. Ford, the city engineer, has reported upon the question. He quotes the act amending the charter which gives the authority to the court of common council to provide by ordinance for the placing of all electric wires underground, and also the ordinance passed by the council in 1896 requiring that whenever the council and the street board consider that public interests demand such action, all electric wires within half a mile, north, south and west of City Hall shall be ordered to be laid underground during the ten years after the passage of the act above referred to, approved June 22, 1895, not more than half of the wires within this area to be ordered laid underground within two years from the date of the act.

Mr. Ford deals with the question as to what shall be done with the wires when removed, saying that the companies can be left to duct their own wires, or string them on poles elsewhere as long as the section under consideration is cleared. He believes this the poorest way, and says that another way is for the city to build a duct system of its own and order all wires drawn into it. This plan has been generally recommended and is in use in Baltimore, Rochester, Utica, Wheeling, New Castle, Pa., Erie, New Britain, Bristol and elsewhere. The city engineer's report goes into the arguments for and against municipal ownership of conduits and considers the method of paying for them, and has something to say of private ownership of conduits, and of the middle course of ordering conduits built by the companies under municipal inspection, which has probably been adopted in more American cities than either of the others. The report urges the importance of municipal supervision and discusses the method of conduit construction. Other heads in the report are: Voltage allowed, induction, plan of conduit system, distribution (by overhead terminals and pole lines by single overhead terminals, and underground), cost estimates, how future extensions should be made. Mr. Ford offers the following conclusions:

First—Before any attempt is made to duct the overhead wires of the various corporations outside of the limits prescribed in the legislative enactment of June 22, 1905, and the confirmatory ordinance passed by the court of common council during the following year, the Hartford Street Railway Company should be compelled to follow the course pursued by the other corporation during the past ten years, and duct all of their feed wires within the half-mile limit from City Hall. If there is available capacity, these feeders should be placed within the conduits of the Hartford Electric Light Company, otherwise within their own conduits.

Secondly—The city of Hartford should at once stop the issuance of permits for the duplication of unsightly poles upon our city streets. The photographs accompanying this report furnish conclusive evidence that miles of telephone wires are run within our city limits upon the same poles with 220-volt service wires, 2,400-volt feeders and arc circuits, and 10,000 volt transmission lines, all with alternating current without interfering with the commercial use of any telephone. I should hesitate to say that only one line of poles would be necessary on streets where there are street railway tracks, on account of the difficulty of using the iron trolley poles for the service which might be required by the different companies; but upon streets where there are no street railway tracks, there is no necessity for more than a single line of poles. I believe that the different companies have in the past insisted upon duplicate lines principally for their own convenience and independence.

Thirdly, the city of Hartford should continue its policy of the past ten years by a gradual extension of its conduit system. There is no better evidence of the civic progressiveness of a municipality than the removal of its dangerous and unsightly overhead wires, as fast as possible.

The city should order underground construction when the local condition requires it; should endeavor to have the different corporations build large enough for the requirements twenty-five years hence; should insist that underground distribution be provided, and should see that all work is done in a permanent manner.

Fourthly, the court of common council should provide by ordinance for a continuation of its conduit system, because the present ordinance only contemplated such construction for the ten-year period from 1895 to 1905. Under the legislative enactment of June 22, 1905, the court of common council has ample authority to order any wires placed underground, under such restrictions as it may prescribe whenever after June 22, 1905, it or the board of street commissioners may consider such action necessary. In order to take full advantage of this legislative authority, it will be necessary for the court of common council to pass additional regulations governing underground construction.

Meeting of the Empire State Gas and Electric Association.

The first annual meeting of the Empire State Gas and Electric Association was held at the Hotel Astor, New York City, on Oct. 31, at 10 a.m. This organization was formed eight or nine months ago and since that time has gained numerically as well as taken steps to place itself in a position of greater influence and usefulness; and the work of the meeting this week can but result in establishing the body upon a high plane and in its rightful sphere of importance.

The meeting was called to order by President W. W. Cole, vice-president and manager of the Elmira Water, Light & Railroad Company, at which time some 50 delegates were in attendance, the college room at the hotel being comfortably filled. Mr. T. R. Beal, secretary and treasurer, and secretary and manager of the Poughkeepsie Light, Heat & Power Company, presented the reports of the executive committee and of the treasurer, the former embodying a number of suggestions for the amendment of the constitution. President Cole followed with an admirable address outlining the scope and function of the body and offering valuable ideas and suggestions with regard to future work. This was followed by an unusually good paper by Mr. John Lincoln Wilkie, entitled "Some Aspects of Supervision by the State of Gas and Electric Companies." This paper discussed at some length and very clearly the duties and powers of the new State Commission, pointed out weaknesses and defects in the law under which the Commission operates, and suggested a number of improvements that were worthy of consideration or adoption by the Association as amendments to the law.

After these papers had been read, Mr. Arthur Williams, of the New York Edison Company, and vice-president of the National Electric Light Association, was invited to address the gathering on behalf of the latter body, and did so in a speech of force and clearness, dealing chiefly with the agitation on municipal ownership, and suggesting intimate co-operation between the State organization and the national body for the carrying out of common purposes and for the common defense. He was followed by Mr. T. C. Martin, chairman of the Committee on Progress of the National Electric Light Association, who spoke of the work done by that body, referred to some of the features of the Denver meeting in regard to methods of business getting, and recommended that the Association should lay out its work upon industrial and commercial lines, and while supporting individual members in any fight against injustice, itself avoid getting into politics, as these had often formed an element of danger to such bodies. Discussion followed by a number of members, and the morning session then adjourned.

When the meeting reconvened at two o'clock, discussion was resumed on Mr. Wilkie's paper, and before the session closed resolutions were adopted expressing the sense of the Association as to the relationship of the State Commission to the constituent companies which were so heavily taxed on their franchises, in regard to protecting them from raids and strikes by new organizations desiring to invade fields that were already filled and satisfactorily occupied, and in which large investments had already been made. A most interesting paper was read by Mr. W. S. Barstow, the well-known electrical engineer and president of the New York Electrical Society, entitled "Economic Waste and Competition." This led to a very interesting discussion as to competition, fair and unfair, and the necessity that companies in the field which had been put under the aegis of the State Commission should be able to look to it for relief. One of the members called attention to the fact that although his company was doing good service to the community at low rates, within the past year no fewer than four new franchises had been granted for operation in the same field. It was obvious that if all these companies were allowed to go into business, there must be a period of reckless competition, at the end of which invested capital must again assert itself and the community would suffer, to say nothing of the serious economic waste involved generally.

The election of officers resulted in the re-election of Mr. W. W. Cole, who has proved himself an excellent executive and who at the meeting showed himself to be also a most judicious chairman; Mr. T. R. Meikleham, vice-president, and Mr. T. R. Beal, secretary and treasurer, these being the executive committee, with Messrs. E. E. Witherbee and G. R. Beardslee. The time and meeting place for the next meeting were left in the hands of the executive committee, although a preference was shown by the gathering for New York City.

During the day Mr. Arthur Williams, in behalf of the New York Edison Company, invited any of the members who wished, to visit Waterside Station, and also extended an invitation to attend the lecture to be given on November 2 at the Edison Auditorium on "Scientific Salesmanship of Electric Light and Power," by Mr. A. F. Sheldon. At the adjournment of the meeting a number of new enrollments were made, and the feeling was unanimous that the Association had laid broad and deep the foundations of a most useful and successful existence, bidding fair to equal in its work, if not surpass, any of the territorial organizations already in the field. The utmost harmony prevailed, and it was found possible to discuss all questions of illumination, whether those of gas or electricity on a common platform and with a common point of view.

Statistics of American Railroads.

The advance sheets of the thirty-eighth issue of that valuable compendium *Poor's Manual of Railroads*, contain a mass of data as to the condition and operation of American steam railroads—the new land of Egypt for electrical invasion. The length of steam railroads in the United States on December 31, 1904, was 212,349 miles, a net increase of 5,014 miles in the year. The income account of all the railroads in the United States compares as follows:

Traffic earnings:

	1904.	1903.	1902.
Miles of road operated..	213,828.02	205,237.12	199,684.64
Passenger	$456,342,380	$429,705,287	$396,513,412
Freight	1,374,102,275	1,344,150,719	1,197,212,452
Miscellaneous	147,194,058	135,001,820	127,089,036
Total gross	$1,977,638,713	$1,908,857,826	$1,720,814,900
Operating exp. and taxes..	1,338,398,686	1,316,349,313	1,160,788,623
Net earnings	$639,240,027	$592,508,512	$560,026,277
Other receipts	81,357,891	89,485,484	77,663,483
Total available revenue...	$720,597,918	$681,993,996	$637,689,760
*Deductions	627,977,878	560,113,908	528,523,326
Surplus	$92,620,040	$121,880,088	$109,166,434

*Includes: Interest on bonds, etc.; rentals, dividends on stock, etc.

Examination of the figures shows that gross earnings increased $67,780,887 in 1904 over the earnings of 1903, or about 3.06 per cent. The increase in 1903 over the earnings of 1902 was $188,042,926, or about 11 per cent, so that the gross earnings of 1904 are $256,823,813, or almost 15 per cent in excess of the record for 1902.

This increase will be valued the more when it is recalled that 1902 was the record year, both in freight movement and in the revenue derived therefrom.

The greatest actual increase in earnings was in the freight department, the receipts of which aggregate $1,374,102,275 in 1904, as against $1,344,150,719 in 1903, but the increase of $29,951,556 equaled only about 2¼ per cent. The increase in passenger earnings, from $429,705,287 in 1903 to $456,342,380 in 1904, equaled $26,637,093, or more than 6 per cent.

The share capital corresponding to the mileage completed at the end of 1904 equaled $6,447,045,374, against $6,355,207,335 in 1903, this increase equaling $91,838,039, the rate of increase being about 1½ per cent. The funded debt of all the lines at the close of the year aggregated $7,475,840,203, against $6,722,216,517 in 1903, the increase equaling $753,623,686, or more than 11 per cent. The other forms of indebtedness of the several companies at the close of the year equaled $172,519,537, against $448,199,448 for 1903, a decrease of $275,679,911. The total share capital and indebtedness, exclusive of current accounts, of all the roads making returns equaled at the close of the year $14,095,405,114, an increase in the year of $569,781,814 over the total of 1903, $13,525,623,300, the rate of increase for the year being over 4 per cent. The return on invested capital averaged 3.31 per cent on stock and 4 per cent on bonds for the year 1904, as against 3.03 per cent on stock and 4.17 per cent on bonds for the year 1903. This shows an increase of 0.28 per cent in the return on stock and a decrease of 0.17 per cent in the return on bonds.

The Electrical Field in China.

From the United States Department of Commerce and Labor, Bureau of Manufactures, a very interesting report is furnished by Special Agent Burrill on opportunities existing in China for the introduction of electrical machinery and supplies of every description. This vast field, he says, seems to have been almost entirely overlooked by those engaged in this great industry. Mr. Burrill describes what has been done for China in introducing electricity, and furnishes detailed information that will enable capitalists seeking good investments, electrical engineers and manufacturers of electrical supplies to realize that an unusual opportunity awaits them in China. Mr. Burrill's report is dated at Shanghai, September 12, and follows:

In discussing the demand for electrical installation and supplies in China it is probably unnecessary to say that at the present time its development and possibilities cannot be covered in detail, but an outline of the opportunities already presented, the work accomplished and the difficulties under which engineers and construction companies labor in obtaining their supplies and fulfilling their contracts may be useful in indicating to American electrical supply companies the desirability of investigating conditions with a view to placing experienced men here in charge of branch offices.

China has enjoyed less development along civil and electrical engineering lines than any other country of its size and importance in the world and presents a field which has evidently appealed to German, British and Japanese firms, for they are on the ground, although inefficiently represented and poorly equipped to handle a business which has offered and will continue to present great possibilities for our home engineers and manufacturers if they will attack the proposition with the same energy and business ability that characterize their operations and assure success in the United States.

In Shanghai, under the title of electrical companies, there are only two firms (both British) in business, each carrying a stock and doing a class of work which in the United States would be called petty contracting. One handles, as its chief source of income, materials entirely foreign to electrical work, while the other has at its head a man who, with the assistance of native employes, installs wiring for lights and bells in the smaller private homes in Shanghai and does work on electric fans and annunciators. I am informed that throughout the Chinese Empire there is not a branch or agency of any of the large electrical supply companies of the United States, which tells the whole story. The customs duty of 5 per cent on machinery certainly cannot be responsible for this condition, and it is only explainable by the assumption that the opportunities for electrical work in the Far East are not sufficiently well known or appreciated by our home companies.

There are three German firms in Shanghai handling electrical supplies as a side line, and only one of these has made any marked success in this particular field. This company orders supplies from its home manufacturers only when needed for actual work, carrying in stock less material for this line of business than would be kept on hand by the small contractor or dealer in the United States. Their business is general in its character, and in their establishment, in addition to the limited stock of electrical supplies, may be found arms and ammunition, agricultural and other machinery, piece goods, tobacco, cigars and cigarettes. They also buy and sell goat and sheep skins and are, in fact, a general trading company, adopting electrical supplies as an incidental source of revenue. This description applies to the other German firms and is mentioned only to show how little attention is actually paid to a line in which exist great possibilities.

Notwithstanding the disadvantages under which contractors labored, some creditable electrical work may be found in a few of the larger cities, of which a brief description may be of interest. The Tientsin Electric Light Company, installed at a comparatively recent date, is already, it is said, a profitable enterprise, and it is reported that a franchise for a trolley system has been granted, on which work is soon to be started. The plant at Tientsin was installed by Arnhold Karberg & Co., of Shanghai, a German firm, and is up-to-date and regarded of sufficient capacity to meet any probable future demand.

Shanghai has under municipal control unquestionably the best-equipped electrical plant in China, and a franchise has recently been granted for a modern electric railway system.

Canton has also an electric light and power company which has just obtained a thirty-year monopoly, and it is maintained by those best informed as to the situation that conditions would justify the installation of an electrical surface road.

Hong-Kong has a paying electric surface road in addition to a fair electric light and power company.

Peking has an electric light plant. About five years ago the German firm of Siemens & Halske began the construction of a surface road, but the work was interrupted in 1900, and it has not yet been completed.

Hankow is about to acquire an electric light and power plant, but would not, for some time at least, support a trolley line.

There are a large number of small isolated plants for both light and power scattered throughout China, and these, acting as an introduction for larger and more elaborate work along the same lines, are gradually being supplanted by the installation of general plants. It may be assumed that these central plants will, in turn, educate and prepare the native population for the great construction work for which China apparently offers opportunities to foreign skill and enterprise.

As there are no firms in this part of the country carrying even a fair supply of electrical material, there is constant complaint because of the delay in the delivery of the goods ordered for construction work. This uncertainty, coupled with the difficulties of insuring their arrival in proper condition and according to plans and specifications, makes it almost impossible, according to electrical engineers, to give satisfactory estimates on any branch of the work.

In sharp contrast to this condition may be cited the success of the Babcock & Wilcox Company. This firm has in the last two years placed over 11,000 hp in the ports along the coast, and is one of the few companies engaged in the manufacture of mechanical accessories having a properly appointed agent with sufficient knowledge of his line to superintend the installation of his own material.

It is obviously impossible to give detailed information regarding the cost of construction in China. It may be said, however, that Chinese wiremen can be secured for 50 cents Mexican (25 cents gold, approximately) a day. These men would, of course, require constant supervision, but when properly instructed and watched do fairly good work. Poles up to 40 ft. in length, and of any reasonable diameter, can be easily obtained at prices ranging from $3 to $4, gold for the larger sizes (40 ft., butt tapering to 10-in. top). These poles have an average life of eight years under ordinary conditions.

It would take a competent and energetic American engineer a comparatively short time to become familiar with the situation and place himself in a position to enter a field that requires and unquestionably will receive careful cultivation in the near future. It would be necessary, of course, under present conditions, to overcome prejudices and inspire confidence. The boycott temporarily paralyzed American enterprises in China, and although it has collapsed officially it is impossible to predict, because of its far-reaching effects, when normal conditions will be restored. It has produced a feeling of business uncertainty and timidity that neither edicts nor proclamations from Peking can immediately dispel, and the unfortunate ending of the Canton & Hankow Railroad project has filled the Chinese mind with added suspicion and distrust of American methods. Notwithstanding this, however, it is certain that Chinese authorities would not hesitate to entertain a proposition for electrical construction that would be advantageous to a municipality, even though it were made by a representative of a company doing business in the United States.

The Valtellina Three-Phase Railway.

Mr. J. M. Graham, fourth vice-president of the Erie Railroad Company, has recently returned from a visit to Northern Italy, where, in company with Mr. de Kando, chief engineer of Ganz & Co., and Mr. Gustave Leve, second vice-president of the Railway Electric Power Company, he made a thorough inspection of the Ganz Valtellina three-phase railway system, which has now been in operation over three years. Mr. Graham rode over the line in the cabs of motor cars hauling express and local passenger trains, and on locomotives hauling freight trains. He also made a thorough inspection of the overhead equipment, stationary transformers, power houses and repair shops.

Mr. Graham, it is stated, was much impressed with the operation of the entire equipment and particularly with the recuperative feature of the system whereby energy is returned to the line, by means of cascade regulation, when a train is descending a down grade or reducing speed. The saving is not only through the return of energy but also reduction of wear and tear to brake equipment, wheel tires, etc. In the Lecco shop he inspected the bearings of motors, which had a mileage record of over 35,000 miles, but which nevertheless showed scarcely any signs of wear.

According to the official time table, the daily train miles on the Valtellina road are about 1,400, and the daily ton miles—on the basis of 150 tons per passenger train and 350 per freight train—about 300,000. The power generated is 10,000 kw-hours per day, this including for lighting, running shop tools, etc. For the operation of the power house, including the hydraulic equipment, 12 men are employed, there being two generating sets of 2,000 kw each in operation with a third in reserve. For the supervision and maintenance of the overhead equipment of the entire system, with its 65 miles of line, 26 men are employed, and 45 men supervise and maintain the electrical car equipment and transformer sub-stations. To this should be added 12 motormen to make up the entire staff.

The total expenditures are as follows: Power house, $4,310; overhead equipment, $6,980; electrical equipment of cars and locomotives, $6,640; motormen, $5,245, making a total of $23,170 per annum. In contrasting this figure with the cost of operating steam locomotives, it is stated that on the basis of 1,400 locomotive miles per day the corresponding cost of steam traction in this country would be $112,750. An allowance should, however, be made owing to the fact that current for the Valtellina line is generated by water power, and labor is much cheaper in Italy than in America. It is claimed, however, that on the basis of coal at $2.50 per ton and American wages, the difference in favor of three-phase traction would be $50,000 per annum.

The objection made to the three-phase system on account of yard switching was made the subject of a demonstration before Mr. Graham, in order to show that yard switching can be performed as rapidly and successfully with cars and locomotives receiving current from two wires as in the case of steam locomotives.

Mr. Leve states this investigation showed, irrespective of the recuperation feature—an exclusive characteristic of three-phase alternating-current traction—that this system, which has now been in operation for over three years, has not only fully demonstrated the great economy in cost and perfect security of service, but also the capability of providing for every phase of railroad work now performed with steam locomotives, no matter how heavy or intricated the traffic would be.

CURRENT NEWS AND NOTES.

LONDON-ROME TELEPHONING.—It is stated that telephonic communication has been maintained fairly well between London and Rome—1,100 miles—with the use of the Majorama microphone transmitter.

A LONDON HEALTH RESORT.—The London *Lancet* last week made the statement that the Underground Railway, with its ozonized atmosphere, created by the electric discharges and arcing of the motive apparatus, has a very healthy atmosphere, so that a trip on it is as good as one to Brighton or Margate.

NEW YORK LIGHTING PLANT.—The New York municipal lighting plant was started this week, with rubbish and refuse as a fuel basis. There are three Burke generators, each of 150-kw, driven by three Ideal engines of 150-hp each. The current is used for lighting the Williamsburg Bridge, in place of the former Edison service. The bridge lighting has already been illustrated and described in these pages.

REACTIONS OF GASES.—Before a very large audience at the auditorium of the New York Edison Company, Mr. Peter Cooper Hewitt on Oct. 23 delivered an admirable lecture on "Electrical Reactions of Gases." It was the first meeting of the season of the New York Electrical Society. President W. S. Barstow presided. The room, which accommodates about 250 persons, was lit with mercury vapor tubes, as well as incandescents. Mr. Hewitt renewed his work on mercury gas lighting and conversion, and the speakers were Dr. Pupin, Prof. Wills, Mr. Percy Thomas and Mr. C. S. Bradley. A most interesting and instructive evening was spent.

MARCONI HERE.—Mr. W. Marconi arrived on the *Lucania* last week, and under his supervision the Cunarder talked all the way over with other steamers. When interviewed, he said: "The most important thing I have to tell you," said Mr. Marconi, "is that we propose soon to install long-distance transmiting machines on the 25-knot Cunarders now being built. That is something that has not been done before—the transmitting of long-distance messages on shipboard. The instruments will cost $25,000 each. We propose to establish in the near future a commercial system between England and Canada." Mr. Marconi will not be here long, but is to lecture this winter before the New York Electrical Society.

AN EXAMPLE.—We quote the following from the New York *Times*: "Considering the prominence of municipal ownership in this campaign, it is a pity—or a delight, according to the point of view—that the experiment New York is making with its municipal ferry does not start more auspiciously. Before the boats began running many old and efficient employees were discharged. Then the operation when begun left nearly everything to be desired. And Sunday there was a strike, or rather would have been a strike, if the demands had not been granted, to avoid tying up the entire service. However, it is promised that all will be well next week, after election in fact. We hope so, but as matters stand, remark that things are not altered by altering their names. The Staten Islanders wanted and want better communications, not another name for their ferry. Municipal ownership is not a conjurer's wand."

NON-SYNCHRONOUS INDUCTION MOTOR.—In a patent issued October 24, Prof. D. C. Jackson proposes a method of arranging the primary coils of an induction motor so that the speed of the rotor is governed by conditions other than the state of synchronism with a rotating magnetic field, and thus of providing a rotor whose theoretical limit of speed may be as high or as low as desired. The inventor disposes the primary and secondary coils unsymmetrically or excentrically with respect to each other. The arrangement consists in increasing or decreasing the normal size of the polar circle of the primary with reference to the secondary, and displacing the respective axes of the stator and the rotor, or of so distributing the primary windings, for instance, that they will by unsymmetrically arranged about the rotor circumference. The inventor states that under these conditions the amount of deviation of the speed from so-called synchronism will depend upon the relative distortions of the primary windings, and an accurate speed control may be effected by altering the distribution of these windings.

ELECTRIC LOCOMOTIVES.—In an address last week before the New England Street Railway Club, Mr. A. H. Armstrong brought out the point that the present maximum schedule speed in use on interurban lines in the West is about 35 or 36 miles per hour, with a maximum speed of 65 miles per hour and a motor equipment of 500-hp per car in two-car or three-car trains. A three-car interurban train of this character can easily develop as much power as the heaviest steam locomotive. Mr. Armstrong emphasized the importance of small wheel diameters in electric locomotives and stated that the dead weight per axle, even with the armature directly mounted thereon, is actually less in the New York Central electric locomotive than in many steam locomotives. An interesting illustration of the New York Central locomotive's enormous accelerating power was given by the speaker, who said that on the testing track near Schenectady the 6,000-type locomotive with seven passenger cars attached was started from standstill, when the steam locomotive of the Empire State Express, traveling at full speed, reached the rear of the electric train's last car and it caught up with the steam train before the last car of the latter could pass the electric locomotive. The New York Central locomotive has now been run about 27,000 miles in a 50,000-mile endurance test, with very satisfactory results. The speaker closed his address with a brief description of the single-phase compensated type motor, touching incidentally upon the field of the gasoline-electric car for thinly populated branch line service.

CAMDEN CONDUIT SYSTEM.—An agitation has been in progress at Camden, N. J., for putting the wires underground, and the City Counsel has been directed to prepare a bill enabling the city government to build its own conduit system in which the operating companies must rent ducts.

A WIRELESS CHALLENGE.—Dr. Lee De Forest has challenged Mr. Marconi to a wireless telegraph competition. The origin of this seems to have been the remark of Mr. Marconi that the recent De Forest feat of receiving messages 1,100 miles from the President's cruiser, "West Virginia," off the Atlantic Coast, was not uncommon, and was not comparable with the feat of signaling across the Atlantic and from mid-Atlantic to both shores. Dr. De Forest now proposes that a test shall be made with apparatus of like power. In other words, he challenges Mr. Marconi to demonstrate that vessels equipped with Marconi apparatus of like power with his own can successfully transmit to stations using Marconi receivers legible messages at any speed whatsoever over distances one-half or one-third those covered by the apparatus used on board the "West Virginia"; the test to be made over land or sea.

CHICAGO MUNICIPAL ROW.—A special dispatch from Chicago of October 28 says: "At a meeting of the Municipal Ownership League of this city last night seven members of the executive committee were expelled upon the ostensible grounds that they had been absent from two or more successive meetings of the committee. Those expelled are Clarence S. Darrow, special traction attorney for the city; Joseph Medill Patterson, Commissioner of Public Works; Henry M. Ashton, special gas attorney for the city; John C. Harding, member of the Board of Education; Joseph A. O'Donnell, West Park Commissioner; Leopold Saltiel, of the Turner Societies, and E. M. Nockels, secretary of the Federation of Labor. Mayor Edward F. Dunne, when informed of the removal of a number of his friends, said: "If there is any fight between the Illinois Public Ownership League and the Municipal Ownership League, I have not been asked to take sides in it. I have not formally affiliated with any of the bodies."

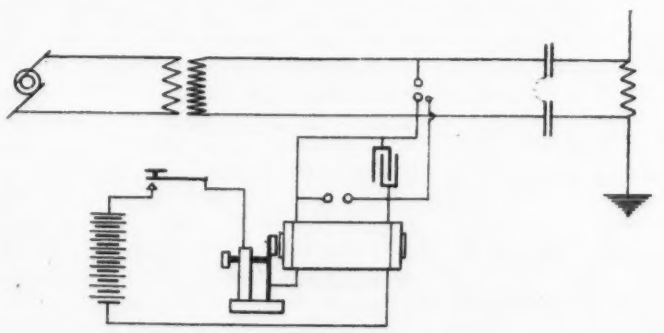
CAPITALIZING A PERSONALITY.—The greatest personality in the American industrial world to-day is Mr. George Westinghouse, whose genius and industry have deeply affected many fields of invention and effort. It is noted that the increase of $5,000,000 in the capital stock of the Westinghouse Machine Company brings the total capitalization of the various Westinghouse companies up to nearly $100,000,000, employed in which are about 30,000 workmen. The Air Brake Company has $11,000,000 capital; Electric Company, $25,000,000; Union Switch & Signal, $3,000,000; British Westinghouse Electric, $5,000,000, and the others, making a total of nineteen in the United States and seven in other countries, furnish the rest. If the total annual output equals the capitalization, as it probably does, the yearly production of apparatus, all bearing the Westinghouse name or stamp, is $100,000,000, in the industrial arts. Such is the beneficent creative power placed by Providence in the hands of one man.

ELECTRIC HEATING.—President Blood, of the National Electric Light Association, has appointed Mr. James I. Ayer to report on the progress of electric heating at the next convention of the association, to be held in May or June next. The report made by Mr. Ayer on this subject at the Denver meeting attracted a great deal of attention and was very fully discussed, both report and discussion showing clearly how much can be done in the way of getting new business by demonstrating the comfort and convenience, as well as the economy in many cases, of the use of various household utensils operated by electric current. This industry is constantly advancing in efficiency and variety of apparatus, and Mr. Ayer's next report will be looked for with interest. It is worthy of note that one or two of the larger stations in the association have recently established an electric-heating department with the object of pushing this branch of the industry. The Edison Electric Illuminating Company of Brooklyn may be mentioned as an example. Such a department would be proportionately valuable in smaller stations.

PHOTOGRAPHIC TELEGRAPHY.—A cable dispatch from Munich, Bavaria, of October 28 says: "Prof. Korn, a leading electrical inventor, claimed in a lecture before the Electrotechnical Association that the problem of transmitting photographs by telegraph had been solved in principle, and it was now possible to transmit a photograph or sketch six inches square in from ten to twenty minutes. This was done over a telegraph line between Munich and Nuremberg, but was equally practicable over 5,000 miles. The photograph to be transmitted is placed in a transparent glass cylinder which revolves slowly, at the same time moving from right to left. A ray of electric light is thrown upon the cylinder and lens, and when the ray reaches the interior it is brighter or darker, according to the coloring of that particular part of the photograph through which it passes. Inside the cylinder is some selenium, which transmits an electrical current in proportion to the intensity of the light brought to bear on it. The selenium transmits the current more rapidly in bright and less rapidly as the light decreases. This selenium is connected with a wire over which the photograph is transmitted. The receiving station consists of a Nernst lamp placed inside a glass cylinder covered with sensitized paper. The Nernst lamp burns more or less brightly, according to the varying current transmitted by the selenium at the other end, and thus reproduces the exact shade of the original photograph."

WIRELESS COMMUNICATION WITH THE PRESIDENT AT SEA.—The armored cruiser *West Virginia* which conveyed President Roosevelt to Washington, after his trip through the Southern States, was, on Oct. 28, in wireless communication with the Washington Navy Yard. The cruiser was in the Gulf of Mexico at the time, and was 1,100 miles distant from Washington. The signals were received from 2:07 until 5:14 o'clock in the morning. The message picked up at the Washington Navy Yard was passing from the *West Virginia* to the armored cruiser *Colorado,* which, with the *Pennsylvania,* accompanied the first-named vessel up the coast, and stated that the *West Virginia* would probably join the *Colorado* and *Pennsylvania* off Key West about noon on Oct. 28. As soon as the noise of the machinery and engines at the yard began before seven o'clock in the morning, it became impossible for the wireless station to communicate further with the cruiser. A despatch from Kansas City states that the wireless messages transmitted from the *West Virginia* were intercepted Friday night by a field wireless telegraph apparatus used by the signal corps at Fort Leavenworth. Major George O. Squier and Captain William Mitchell were at the time experimenting with an instrument connected to a kite when they caught the messages from the President's boat. They tuned their instrument to various frequencies and intercepted messages from other ships at sea off the Atlantic coast. This, it is stated, is the first time that wireless messages coming from ships on the Atlantic Ocean have been intercepted so far inland. De Forest apparatus is used on the cruisers.

SPARK TIMING APPARATUS FOR WIRELESS SIGNALING.—In order to overcome the disadvantages of the direct make-and-break key employed with wireless telegraph transmitters, Mr. L. De Forest, according to a patent issued October 24, would use a so-called "trigger-spark" adjacent to the main spark, for the purpose



of timing the main spark. The apparatus is based upon the principle that ultra-violet radiations, or an ionizing influence, decreases the resistance of a gaseous dielectric. The inventor uses a small power auxiliary spark near the main spark, so that the main spark which is normally inoperative may be made operative for such a time as the ionizing radiations are given forth by the auxiliary spark.

SALEM, MASS., is once more defying the witches, this time by an electrical carnival, associated with parades, special lighting, X-ray exhibits, etc., that in the olden days would certainly have involved the summary execution of all concerned.

TELEPHONY IN TRAVEL.—It is stated that when important officials of the Pennsylvania Railroad go to Pittsburg by private car a telephone in the car is connected up immediately on arrival with the railroad exchange and the local exchange. The convenience is enormous.

THE SOFT ANSWER.—Is it true, says the *New York Sun*, that most voices sound snappy and disagreeable over the telephone? Men say no and women say yes, especially when a mere man is speaking over the wire. Is it not true also that many women, indeed very many women, knowing the acoustic perils of telephone wires, have cultivated a telephone voice—insinuatingly gracious, invitingly gentle and and charmingly persuasive?

IN A LIBRARY.—It is noted in the U. S. Consular Reports that the removal of the Heidelberg University library, containing more than 700,000 volumes, into a new and handsome sandstone library building has just been completed. The work of removal employed 15 men 32 days. Each separate book was freed from dust by a cleaner operated by an electric motor, of the form used in house and carpet cleaning, the back and edges of each book being subjected to the powerful suction of the cleaner with highly satisfactory results. The library requires about 21 miles of shelf room.

BLACK SAND.—In our issue for October 14 mention was made of investigations being conducted at Portland, Oregon, by Dr. D. T. Day, of the U. S. Geological Survey, to determine the mineral value of black sands from placer mines. A San Francisco correspondent writes that one ton of black sand from Guadalupe, Cal., has been treated at Portland, and that over 600 lbs. of steel has been produced therefrom by the use of an electric smelting furnace, after concentrating. A large electric furnace is to be constructed. It is stated that some gold is recovered by the new process.

SUBWAY SIGNALS.—The New York Electrical Society is promised a "demonstration" paper this winter on the block signal system of the Interborough Subway. The system has now been in operation one year, and the number of automatic signal movements for the eleventh month (September) was about five millions. The number of signal failures in that month, all on the side of safety, was 11, which is an average of one failure to 464,694 movements. With this enormous movement there was, it will be seen, not a single relay failure. Three of the 11 failures were caused by water leaking through the roof near Central Park.

WIRELESS INLAND.—We described recently the Murgas wireless telegraph system at Scranton, Pa. A correspondent writes us: "I saw Father Murgas a few minutes ago, and he told me that both he and his operators at Scranton and here have been receiving outside messages from many different points not connected with his system, including several from incoming ships entering both New York and Philadelphia harbors. The signals are quite clear and distinct, scraps of conversation, figures, etc., coming in and being decipherable for long periods of time. He claims that he can place the tuning of any system in a few seconds, of any station or number of stations, and can take complete messages from them."

THE TROLLEY IN JAPAN.—The Kobé (Japan) *Chronicle* of recent date says that it looks as if there will be a boom in electric railways. The Government railway passenger traffic between Kobé and Osaka have been so affected by the Hanjin Electric Railway that the imperial railway working bureau is considering the advisability of establishing an electric line between the two cities and so meeting the competition. The bureau is also considering the establishment of such a railway between Tokyo and Yokohama. The extent of this competition may be judged when it is considered that the business man living in Kobé, who has to make frequent visits to Osaka, by using the electric railway not only saves enormously in the amount of fare, but travels nearly as quickly. He uses the electric route because of its freedom from soot and smoke.

WORTH A HUNDRED MARKS.—It is stated that a few weeks ago a large flag was seen flying from one of the towers of the Cologne Cathedral, 487 ft. above the street level, bearing the inscription: "Kabelt via Emden-Azoren" (Cable via Emdene-Azores). It is entirely against all the traditions and instructions of the ecclesiastical authorities of that celebrated cathedral to countenance anything in the shape of an advertisement, and very shortly after its appearance the flag was hauled down. It appears a bet was made between one of the employes of the German-American Cable Company and a steeple jack that he would not dare for 100 marks to affix to the topmost spire the flag in question. The flag floated to the astonishment of every citizen from the highest church pinnacle of the continent, but the daring steeple jack was arrested and fined 100 marks with a threat of dismissal should he ever dare to repeat such sacrilege.

THE NEW HAVEN RAILROAD.—With regard to the adoption of alternating-current locomotives by the New York, New Haven & Hartford Railroad, instead of direct current, like the New York Central, and the effect on the Grand Central depot, the following dispatch from New Haven of October 27 says: "C. S. Mellen, president of the New York, New Haven & Hartford Railroad, declared to-day that there was nothing whatever in a report that the New Haven road would quit the New York Central. He said: "Our continued use of the Grand Central Station is assured. There has been no thought of going elsewhere. When the Pennsylvania Station is completed there will be a through service established by way of the same to points south and west, and possibly, if there is a public demand, some service locally may be established to and from that station. But that is so far in the future that no action looking to such a result has been taken as yet."

ELECTRIC LIGHT A PROTECTOR.—An interesting confession from the "under world" is contained in an article in the *Ladies' Home Journal* for November, in which a burglar discusses his own "business" and outlines protective measures. The following passage is very significant: "Other things being equal, a burglar will always pass a house lighted by electricity for one lighted by gas. The reason for this is that houses lighted by electricity are now wired in such a manner that the turn of a switch or the pressure of a button on one floor will illuminate another floor. Then, electrically-lighted houses are much more likely to be equipped with modern burglar alarms. Houses so wired are practically traps for the burglar. He may be working on the ground floor, for example, when some member of the household in a chamber above is aroused and fancies that he hears some one moving about below. At once the man of the house reaches for the electric switch and turns on the light for the lower floor, so that the burglar suddently finds himself in a blaze of light, while the man of the house, a gun in his hand, is screened by the darkness. This puts the householder in a position to shoot without being shot at."

TELEPHONE BONDS.—The United States Census Report showed for the telephone industry at the close of 1902 a total issue of bonds outstanding of $73,981,361, or 21 per cent of the total capitalization. The bonded debt has of late made a relatively rapid growth, and the *Wall Street Journal*, a highly competent authority, thinks that the amount now outstanding may have reached $150,000,000. It also says: "It is taken for granted that the bonds considered cover actual cost or less, and the value of the plant as a going concern has been neglected here for that reason. There are other points of interest to the telephone bondholder, such for instance as the actual participation of real estate and buildings in the "unearned increment" of surrounding property, but for general purposes the more important points have been outlined above. As in every investment field there are all grades of telephone bonds ranging from those that sell on a 4 1/10 per cent basis, such as American Telephone & Telegraph 5 per cent notes, down to bonds of the lowest grade. In the middle ground there are bonds with various rights to consideration, and doubtless as the volume of such bonds grows and as the industry is better understood by the public, telephone securities will become increasingly popular."

PRESERVING NIAGARA.—It is announced that Secretary Root will soon open negotiations with the British Government for the purpose of reaching an agreement for the preservation of Niagara Falls from further utilization, and to protect the scenic beauty of the spot.

AUSTRALIA.—The principal imports of Australia during 1904 included $947,230 for electrical goods, $715,870 for scientific instruments, $8,372,279 for machinery and $354,590 for machine tools. The trade with the United States included $74,970 for electrical goods, $1,931,485 for machinery and $129,995 for machine tools.

TRAFFIC OF LONDON.—The Advisory Board of Engineers to the Royal Commission on London Traffic reporting on urban transportation finds that total tramway mileage completed and under construction is 350 miles, and the population served 6,850,000. The number of local passenger journeys is 1,164,000,000 per annum or 170 per capita. The per capita in New York is 300, in Berlin 270, and in Paris 200.

WELFARE WORK.—An article on "Welfare Work," by Mr. H. H. Vreeland, chairman of the Welfare Department of the National Civic Federation, is a prominent feature of the October issue of the *Monthly Review*, published by that organization. As president of the New York City Railway Company, Mr. Vreeland is a large employer of labor, and as he has come up from the ranks he writes with knowledge acquired through personal experience of the needs and opportunities for improving the physical, mental and moral condition of wage-earners. The article is a compact and comprehensive treatise upon its subject. It is illustrated with some pertinent examples of practical welfare work.

AN ELECTRICITY EATER.—The man sat on the grass in Central Park last week gazing intently at the sky through a two-foot gas pipe. His clothes were inside out and around his chest and waist were coiled about 50 ft. of clock spring. "Who are you and what are you doing there?" asked Policeman Cain, happening along. "'S-h-h-h," answered the stranger. "I'm the wonder of the age. I eat electricity. I'm hungry and am out for dinner." "That so?" observed Cain. "What's all this business?" indicating the clock spring and the gas pipe. "This," said the man, pointing to his wire armor, "is that with which I gain breakfast, dinner and supper. It contains the negative and the positive. It keeps me alive. It brings my food from Heaven. And this," indicating the pipe, "is that with which I search for sustenance." He was gathered in and sent to Bellevue Hospital.

RUSSIAN TURMOIL.—The political upheaval in Russia is being accompanied by a stoppage of electric lighting plants and trolley cars, by strikers and revolutionists. The telegraph and telephone services are also seriously interrupted and no one seems to have thought of wireless as a substitute. A strike in the Post Office, including the telegraph operators, began October 29, and communication with the interior practically ceased. Army operators were placed in the telegraph offices, but only a few lines are working. Many lines, including the land lines to the continent and to Libau, where they connect with the cable, have been cut. Cable connections generally appear to be out of order. In St. Petersburg the government authorities have made patrol use of a searchlight mounted on a high building on the Nevsky Prospect.

RESCUE BY WIRELESS. By means of the De Forest wireless apparatus installed on the steamship *Lucas* and on the steamer *City of Everett*, the latter vessel was discovered in a sinking condition in a storm which raged all day October 9, and most of the next day. Operator Heimbecker, of the *Lucas*, was at the receiver when he found another steamer calling. He established immediate connection with the operator on board the *City of Everett* and learned that a hatch on her forward hold had been washed away and that she had shipped so much water that the captain feared she might founder any minute. The *Lucas* stood by for twenty-nine hours, placing herself between the damaged steamer and the wind, thus enabling the *City of Everett* to make temporary repairs, and pump out the water in her hold. She then proceeded to New York, while the *Lucas* continued on her way to Port Arthur.

Electrical Engineers of the Times.—XXXIV.

MR. A. J. WURTS.

Alexander Jay Wurts was born at Carbondale, Pa., March 3, 1862. On the maternal side he is descended from John Jay, first Chief Justice of the United States. His father was a civil engineer by profession. His early education was obtained at the schools of New Haven, Conn., and in 1879 he entered Yale University from which he was graduated with the degree of Ph. B. in 1883. After graduation a post-graduate course was followed at Stevens Institute of Technology, from which institution he received in 1884 the degree of M. E. The same year Mr. Wurts went abroad and took a special course of electrical engineering at the Polytechnicum, Hanover, Germany, under Prof. Kohlrausch.

Returning to the United States in 1886, Mr. Wurts served an apprenticeship with the United States Electric Lighting Company in Newark, N. J., and later was manager of the Julien Storage Battery Company, of Camden, N. J. On November 1, 1887, he joined the Westinghouse Electric & Manufacturing Company in Pittsburg, where he continued laboratory and engineering development work for about ten years. During this period he became interested in protective apparatus, particularly with reference to lightning protection, and discovered the non-arcing metals for which he received the John Scott Medal from the City of Philadelphia upon the recommendation of Franklin Institute. Mr. Wurts' work in this

MR. A. J. WURTS.

line revolutionized lightning protection apparatus, and the new types he evolved are now adopted in standard practice throughout the world. In 1898 he undertook, for Mr. Westinghouse, the development of the Nernst lamp, in which, with his associates, he was particularly successful, after three years having carried his work to such a state of advancement that a large factory for the commercial manufacture of the lamp was equipped in Pittsburg, of which Mr. Wurts was made manager.

In 1904 he tendered his resignation to the Nernst Lamp Company and returned to the Westinghouse Electric & Manufacturing Company under an arrangement whereby half of his time was to be devoted to the company and the other half to the Carnegie Technical Schools, where he was attached to the staff of Director Hamerschlag. In July of the present year Mr. Wurts was appointed Professor of Applied Electricity and head of the Electrical Engineering Department of the Carnegie Technical Schools. In this position he will initially have charge of the organization of the course of electrical instruction and the design and equipment of the laboratories connected therewith—duties for which he is admirably equipped, both intellectually and from his wide experience in research work. As a teacher he is no less qualified, having in his numerous papers and lectures on technical subjects shown the possession to a high degree of the art of exposition.

Mr. Wurts has presented a number of papers before engineering societies and frequently lectured before universities, and has also contributed to the technical press. He is a member of the American Institute of Electrical Engineers, the American Philosophical Society, the American Association for the Advancement of Science and the Pittsburg Academy of Science and Arts.

Niagara Power in Buffalo.

BUFFALO received 24,000 electric horse-power from Niagara Falls last December, for the operation of lamps, stationary motors and street cars Of this total about 7,000 hp was delivered to the International Railway, and the other 17,000 hp represented the entire load of the electric supply system in that city.

During the 24 hours of December 5, 1904, the total electric load in the terminal house of the Cataract Power and Conduit Company for the Niagara transmission lines at Buffalo varied between a minimum of 7,000 hp at 2:30 a. m., and a maximum of 23,900 hp at 5:15 p. m., as shown in Fig. 1. On this same day the minimum load at the terminal house between 8 and 11:45 a. m. was 17,000 hp. Compared with the like load curve for December 18, 1903, that of December 5, above named, shows nearly the same minimum, and an increase of about 600 hp in the maximum demand.

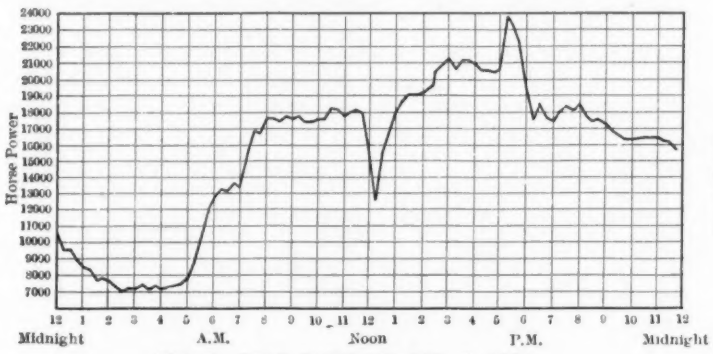


FIG. 1.—LOAD CURVE FOR DEC. 5, 1904.

On June 6, 1905, the total load on the Niagara transmission line at Buffalo had its minimum of 6,000 hp at 4:45 a. m., and its maximum of 18,900 hp at 5 p. m. (See Fig. 2.) About 6,000 hp of this maximum was the street car load. Between 7:30 and 11:45 a. m., and between 1:15 and 5:15 p. m. the electric load was not below 17,000 hp. This June load of 1905 was nearly the same at its minimum as the load on the eighteenth of the corresponding month of 1904, but the maximum load of the latter year was 1,600 hp greater than that of the earlier. So also the lowest point of the day load between 7:30 and 11:45 a. m., and between 1:15 and 5:15 p. m., was some 3,600 hp greater in 1905 than in 1904, on the June days named.

With an increase of load more than twice as great during the regular working hours of the day as at the time of peak load, it seems that the largest additions to the electric service in Buffalo are being made with motors for industrial purposes. An interesting illustration along this line may be noted in the 1,500 hp direct-connected motor and vertical pump that has been installed at the pumping station of the Buffalo water works during the past year. This pump is of the centrifugal type, and has a capacity of 25,000,000 gallons of water per day of 24 hours, or 775,000,000 gallons per month of 31 such days. At the upper end of the pump shaft a vertical induction motor of 1,500 hp capacity is connected, as indicated in Fig. 3. Three-phase, 60-cycle, 2,200-volt power is supplied to this motor by the Cataract Power and Conduit Company at the rate of nine dollars per million gallons of water pumped when 387.5 million gallons are pumped per month. On larger quantities of water per month the discounts from the pumping rate just named are as follows:

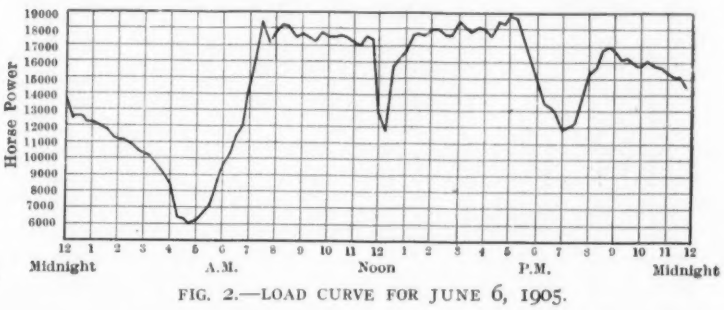
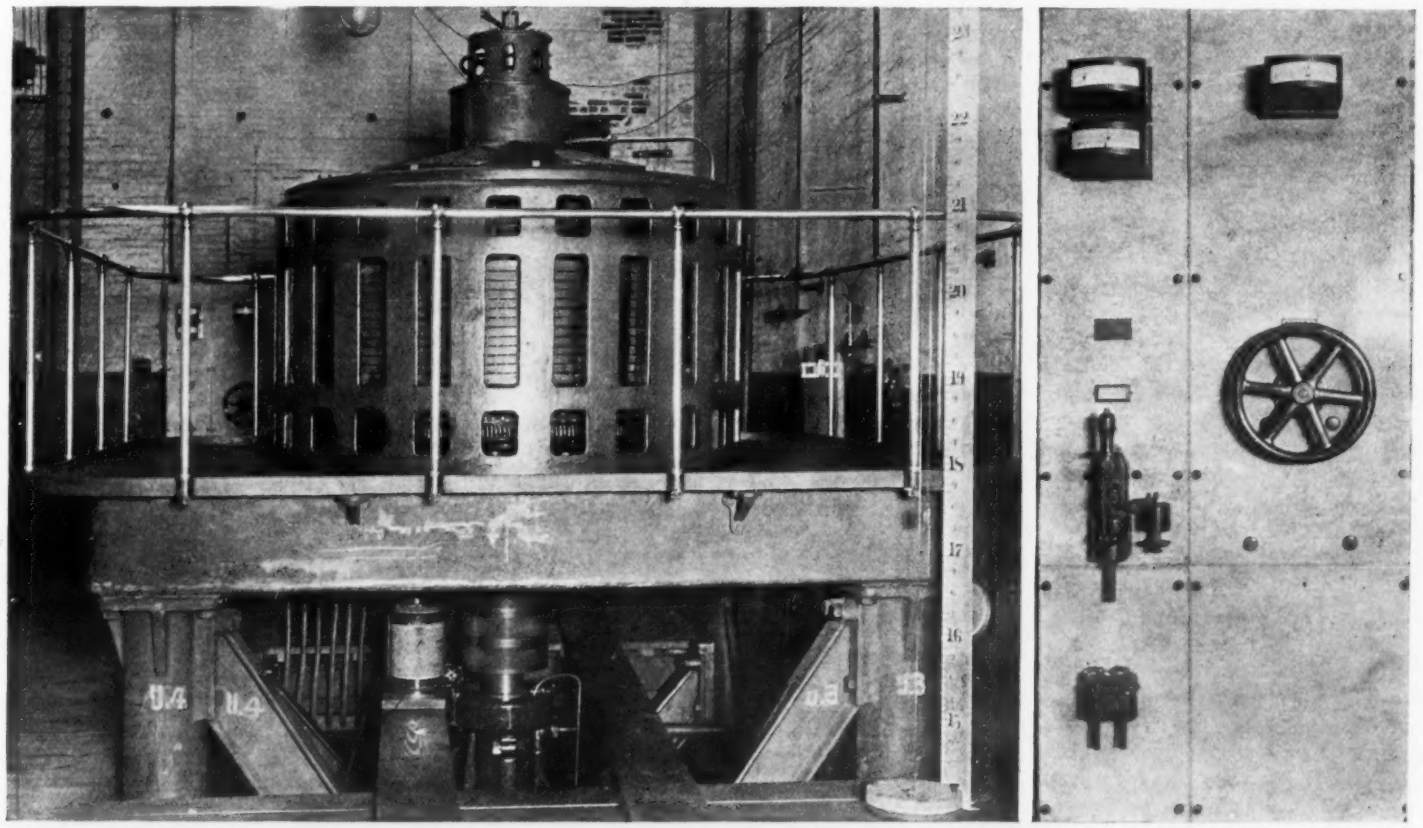


FIG. 2.—LOAD CURVE FOR JUNE 6, 1905.

387.5	to 465	million gallons	11½	per cent	discount
465	to 542.5	million gallons	20⅝	" "	"
542.5	to 620	million gallons	29⅘	" "	"
620	to 697.5	million gallons	37½	" "	"
697.5	to 775	million gallons	44⅘	" "	"
775	and over	million gallons	50	" "	"

This pumping is done against a water head of substantially 200 ft. For the quantity of water raised by the pumps when working at full capacity during twelve hours per day and 31 days per month, that is 387.5 million gallons, the maximum rate of nine dollars per million gallons is charged. In order to secure the discount of 50 per cent the pump must operate at full capacity 24 hours per day and 31 days per month. If the electric motor has an efficiency of 90 per cent when it is operating the pump at the rate of 25,000,000 gallons of water per day, and if the pump then has an efficiency



FIGS. 3 AND 4.—DIRECT-CONNECTED 1500-HP INDUCTION MOTOR AND ITS SWITCHBOARD.

of 80 per cent, the work done on the water must represent .90 × .80 = .72 of the energy entering the motor. When water is pumped at the rate of 25,000,000 gallons in 24 hours, 2,413 lb. of the water must be lifted per second, and since the head against which the pump works is 200 ft., the rate of work in lifting this water is 877 hp. On the basis of 72 per cent efficiency in the combined pump and motor, the electric horse power that must be delivered to the latter is 1,213 in this case. The operation of this pump is so economical in comparison with the cost of steam pumping, that the city of Buffalo is making plans for an electric pumping station to contain not less than eight 25,000,000-gal. pumps.

During the second half of 1904, the output of the Cataract Power and Conduit Company in kilowatt-hours was greater by 15 per cent than the output during the corresponding half of 1903. So, again, in the first six months of 1905 the company had an energy output greater by 18 per cent than the output of the corresponding period of 1904. For the year ending with June 30, 1905, the number

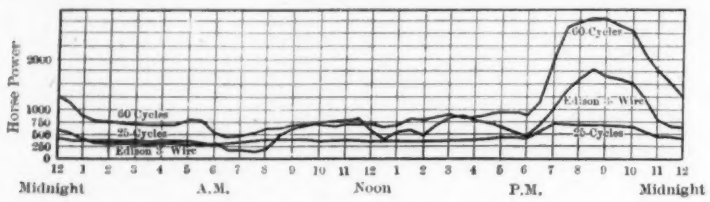


FIG. 5.—LOAD CURVE FOR SEPT. 2, 1905.

of kilowatt-hours delivered by the company showed an increase of 17 per cent over the corresponding year ending in 1904, and 29 per cent over the year ending in 1903.

Transformers with an aggregate capacity of 18,096 16-cp lamps are operated with 25-cycle current from Niagara Falls for incandescent lighting by the Buffalo General Electric Company.

Such an extended application of alternating current at this low frequency to incandescent lighting is notable because of the opinion held by many engineers that 25-cycle current cannot give satisfactory results for this service. In spite of this opinion elsewhere, the load of incandescent lamps on 25-cycle circuits is rapidly moving upward at Buffalo, and lamps are being operated with such current in buildings where it is fair to assume that first class service is demanded. Among the more important institutions using incandescent lamps on 25-cycle circuits are the following, the number of lamps in each being indicated:

Buffalo Club	678
Grosvenor Library	246
Lafayette High School	1,647
Genesee Hotel	1,500
Athletic Park	4,000
Buffalo Country Club	150
Park Club	200
74th Regiment Armory	1,500
Albright Art Gallery	297
Total of above	10,218

All of these incandescent lamps are of 16 nominal candle power, save that there are 82 lamps of 32 cp, and 167 lamps of 8 cp at the Buffalo Club. Besides the above, the Albright Art Gallery has 265 Nernst lamps operated with 25-cycle current.

The number of each size of service transformer operating incandescent lamps with 25-cycle current, and the total lamp capacity in each size is given below:

Lamp Capacity, Each.	No. of Transformers.	Total Lamps.
12	43	516
20	41	820
30	51	1,530
50	38	1,900
80	27	2,160
60	2	120
70	2	140
100	19	1,900
150	3	450
180	2	360
200	6	1,200
300	11	3,300
800	1	800
490	1	490
90	1	90
160	2	320
400	5	2,000
Totals	255	18,096

For these 255 transformers the average capacity is 71 lamps each.

Quite a portion of the incandescent lighting with 25-cycle current is done in residences, as well as in public places. Current for incandescent lamps is distributed in three forms by the Buffalo General Electric Company, that is at 2,200 volts and 25 and 60 cycles, and on a three-wire 250-volt system. The Edison three-wire system is confined to the business portion of the city. Sixty-cycle current is distributed both in the business section and in the suburbs, and 25-cycle current is now being adopted on many extensions where 60-cycle current would formerly have been employed.

An idea of the importance of the 25-cycle service may be gathered from the load curves of the system operated by the Buffalo Company during the 24 hours of September 2, 1905, shown in Fig. 5. On that day the output of 60-cycle power ranged between a minimum of 470 hp at 6:30 a. m. to a maximum of 2,775 hp at 8:30 p. m. During this same day the load on the three-wire direct-current system reached a minimum of 130-hp at 7:30 a. m., and its highest figure was 1,761 hp at 8:30 p. m. Power at 25 cycles for incandescent lighting in this same 24 hours was down to a load of 310 hp at 6 a. m., and reached a maximum of 698 hp at 7 p. m. At 8:30 p. m., when the combined lighting load on the three systems reached its maximum of 5,216 hp, the load of incandescent lamps operated with 25-cycle current was 13 per cent of the total lighting load.

Because of the increasing load on the 250-volt, three-wire lighting system, there arose some difficulty as to its operation from the Wilkeson street sub-station of the Buffalo company, where all of the motor generators for this purpose were located, unless a large increase was made in underground feeders. At the Wilkeson street sub-station the combined capacity of the 150-volt direct-current generators, driven by synchronous motors and operating the three-wire system, is 1,200 kw. This sub-station is about 0.5 mile distanct from the junction of Main and Court Streets in Buffalo, and as much as 0.75 mile from many other points in the business section.

In order to provide for the increasing three-wire load it was decided a little more than a year ago to rent spaces beneath the sidewalks of the city at suitable points along the three-wire system, and to install transforming and converting apparatus in these spaces. The first subterranean station of this sort was located beneath the sidewalk at the corner of Main and Court Streets, where

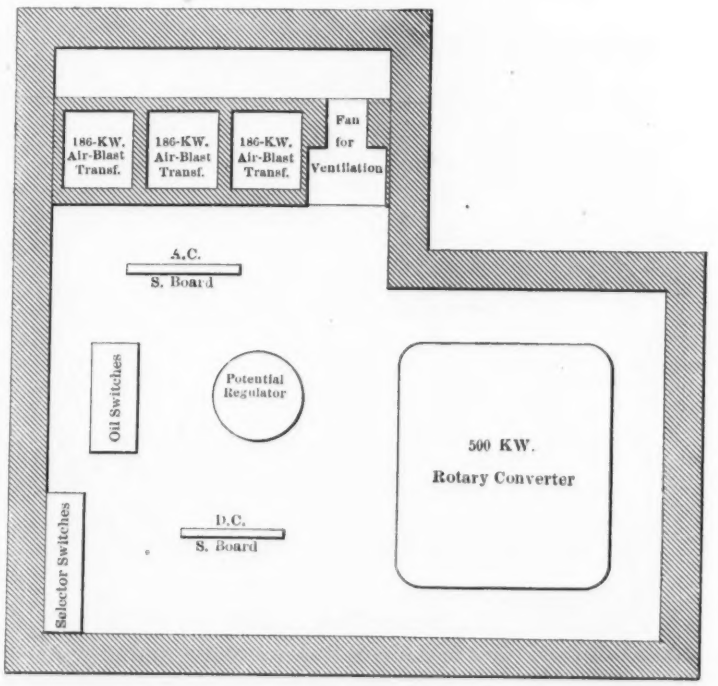


FIG. 6.—PLAN OF SUB-STATION AT MAIN AND COURT STREETS.

thousands of people pass over it daily. (See Fig. 6.) Within its concrete walls, which have a uniform thickness of 18 in., this minute sub-station measures about 453 sq. ft. in ground area, and contains all the necessary apparatus for transforming and converting 11,000-volt, 25-cycle, three-phase current to direct-current at 250 volts. On reaching this sub-station the underground cables carrying the 11,000-volt current pass to electrically-operated oil switches, and thence to three air-blast transformers rated at 186 kw each. The secondary windings of these transformers connect with an automatic potential regular and with a rotary converter rated at 500 kw and 220 to 280 volts on the direct-curent side. From this converter, cables pass to a switchboard and then out to connect with the positive and negative conductors of the three-wire system only a few feet distant in a

street manhole. Floor, walls and ceiling of this sub-station are of concrete and steel, and it is left much of the time without an attendant.

Another sub-station similar to the one just described is being completed, and these two will increase the capacity of the system by 1,000 kw.

Regulation of voltage on the two sides of the three-wire system is done exclusively at the Wilkeson sub-station, as the four generators there are connected in pairs, while the rotary converters in the two subterranean sub-stations connect only with the outside wires. The construction and equipment of these two sub-stations are thought to offer a good example of a cheap method of increasing the capacity of a three-wire system.

The above facts as to the extending use of Niagara power in Buffalo have been obtained through Mr. Elwood Grissinger of the Cataract Power and Conduit Company, and Mr. Paulding F. Sellers, engineer of the Buffalo General Electric Company.

The Use of the Telephone in Army and Navy Manoeuvres.

BY COL. B. K. ROBERTS, U.S.A.

DURING the recent Army and Navy exercises of 1905, which were held in the Artillery District of the Potomac near Washington, effective use was made of the telephone as a means of communications outside of the regular fire control installations, in order to keep the officers informed as to the movements and approach of the Navy in its attack on the forts which defended the City of Washington. The accompanying illustration shows the lay of the land, and will serve to indicate the various places referred to in the short account of the communications given below. It should be borne in mind that Marshall Point is a forest and that White House Farm and White Stone Point are replete with foliage during the summer.

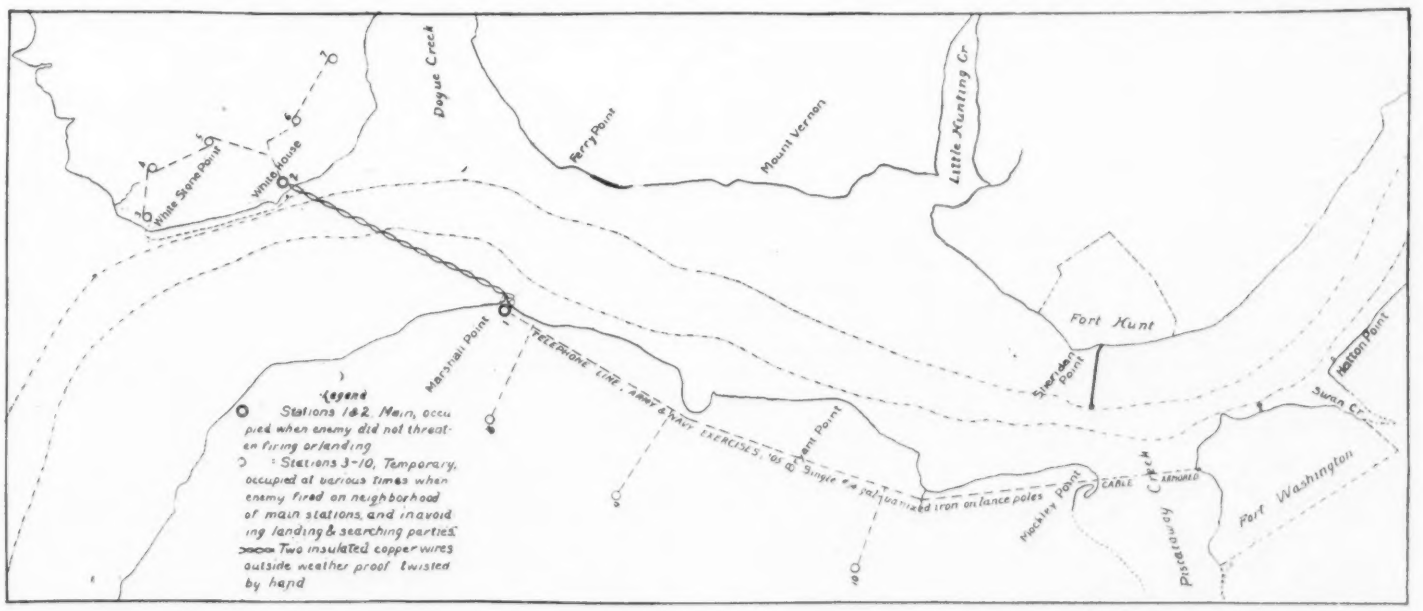
As Forts Washington and Hunt were connected completely by wire by the regular fire control installations, there remained to devise some scheme for obtaining communication by wire, if possible, with outlying signal parties so as to give timely notice of the approach of the vessels of the enemy, and to save in some part the strain on the observers and the strain upon the personnel of the batteries. It was at first decided that the placing of an outlying telephone and telegraph station at Marshall Point would give a view of the stretch of the river next beyond the field of fire and afford a place at which and to which the scout boats could report. The stretch of river referred to is in greater part out of view of the forts. An old piece of armored cable was laid from Fort Washington to Mockley Point and, from the south end, a flying telephone and telegraph line was built to Marshall Point. This consisted of wooden lances about 12 ft. long, each having a hard rubber insulator at the top and a metallic holder for the wire. A single No. 14 galvanized-iron wire was used, the ground being depended upon for return.

It had been planned to build an iron pole line to Marshall Point, but the lance line for the purpose was more flexible, more easily repaired and moved during temporary use. On this line at the ends there was to be used the Signal Corps combination telephone and buzzer kit, a type of instrument now highly developed by the Signal Corps. It was known that this instrument would work through a very poor line, and in fact that it had been made to work (the buzzer system) through actual breaks of considerable size in a single bare wire laid on the ground, notwithstanding the fact that the ground was used as return. As signal parties were to occupy the country at White House and at White Stone Point, where the scout boats would be able more conveniently to report information, it was deemed advisable to connect White House through Marshall Point with Fort Washington. For this purpose two lengths of ordinary No. 14 insulated outside weather-proofed wire were used, twisted by hand, and laid double as a precaution. Most of the wire was old, having been recovered from aerial lines. The double wire was weighted with anything at hand (old pipe and scrap iron) and laid from a small launch. The wire lasted through the exercises and was then recovered. As a matter of fact, the line was so good that the telephone part of the buzzer was used effectively a greater part of the time.

The principles upon which this instrument operates depend upon the comparatively high voltage developed at the terminals of an electromagnet when the current through it is suddenly interrupted and upon the sensitiveness of the telephone as a receiving instrument for feeble momentary currents, especially when they are of the sharply accentuated character produced in the manner just described. An automatic make-and-break vibrator gives a buzzing sound in the telephone receiver, which by short or long contacts of the key produce the dot or dash of the Morse alphabet.

The instrument can now be used on a telegraph line using either the buzzer or telephone over the line while ordinary Morse is being transmitted. This is accomplished by using condensers interposed between the line and the buzzer. No current flows through the condenser as long as the current is steady or nearly so and the comparatively slow pulsations of the Morse sending have no appreciable effect on the buzzers. On the other hand, the very rapid pulsations or undulations produced by the buzzer will produce correspondingly rapid charges and discharges of the condensers and will transmit from one buzzer to the other with little diminution of sound. At the same time ordinary telegraph business will not be interfered with.

The rules of the Army and Navy exercise forbade the landing of parties because there were not enough land troops available to carry out fully the guarding of communications. As a matter of fact the Marshall Hall-Mockley Point lance line was several times cut by a landing party, but it was almost immediately repaired, and



MAP SHOWING LOCATION OF TELEPHONE CIRCUITS.

a Signal Corps man always retained a connection with the wire between the break and Fort Washington, and with his buzzer continued to communicate with Fort Washington, and to report the movements. At one time the landing party succeeded in disconnecting the line at the Mockley Point end of the armored cable, but the fault was immediately traced out and remedied. Dummy wires were arranged at both of the main stations, and, after the landing had once been attempted, the original landing places of the wires under water were abandoned, but the entrance wires to the water were left in sight; the real end of the wire or wires at Marshall Hall was then brought in a boat under the wharf and in a roundabout way to the station. At White House the line was carried along shore under the water to an old abandoned wharf at White Stone Point and thence into the woods. Enough equipage and instruments were left in the tent at each main station to lead the enemy to think that the party had been scared off and that the true station had been captured; meantime an operator was in the woods not far off sending in full reports with a buzzer. A single operator could trail out the wire and keep up communication; when pushed he dropped the wire and went off with the buzzer, and a short time later he made connection at some other point with another length carried by his comrades (each buzzer is equipped with a separate dry battery). Continuous reports of every movement and minute descriptions of every motion and action of every vessel of the enemy were sent in.

Visual signal apparatus was of course on hand at all stations, as were the men for night and day visual signaling in case the line should fail. Except on one occasion when a visual signal informed Fort Washington that the line was broken at Mockley Point, at the cable end, no visual signals had to be relied upon. At the same time Marshall Hall, White House, Fort Washington and Fort Hunt each had its visual signal party on watch through telescopes and glasses, ready to open up communication at a moment's notice. As landing and guards against landing were not matters of interest or contemplated, the incidental cuting of the lines served merely to incite ingenuity on either side, and of course did not affect the main principles involved in the communications.

It is said that very quick work was sometimes done with the buzzer at Santiago and in the Philippines—on the other hand the real value of the buzzer is the power to get actual communication over lines and breaks and faults which absolutely preclude the telegraph and telephone, and where no possible communication could ordinarily be had. Although communication over such imperfect lines is slow, it is of immense importance that some means of communication be at hand. It is worthy of note that in the case above described the line was too good to do justice to the buzzer, for the telephone part of the instrument was always operative, and the buzzer was not called upon for severe service.

Ratio of Electric Charge to Mass of Corpuscles.

An account is given in *Annalen der Physik*, No. 10, of an investigation in which R. Reiger resumed Thomson's work on the ratio of the charge to the mass in cathode rays of the most widely varying origin. Mr. Reiger examined cathode rays proceeding from cathodes of different metals, from hot wires, from hot metallic oxides, from a negatively charged surface under the influence of ultra-violet light and from radioactive substances, as well as secondary cathode rays, and cathode rays transmitted by thin metallic plates. In addition, he produced cathode rays from glass illuminated by ultra-violet light and cathode rays generated within a gas, as in the capillary portions of a vacuum tube, so as to determine whether the rays preserve their characteristics when emitted by an insulator or a gas. The results confirm previous ones in showing that whatever the origin of the rays, the ratio of e to m is sensibly the same, only varying within narrow limits with the velocity of the electrons. For a glass plate illuminated by ultra-violet light, and negatively charged by means of a sheet of tinfoil attached to the back of it, the author obtained values for this ratio varying from 1.03×10^7 to 1.0×10^7 electromagnetic units, the voltage being varied from 8,000 to 10,000. For "strictional" cathode rays the ratio was found to be 1.32×10^7, and for anode canal rays—i. e., cathode rays transmitted through perforations in the anode—Simon's value of 1.68×10^7 was rediscovered.

The Long Island R. R. Electric System.

THE western division of the Long Island Railroad is the most complete example thus far presented of the electrification of a steam railroad system. Work was begun in the fall of 1903, and on July 26 of the present year all lines leading out of the Flatbush Avenue terminus of the company commenced electrical operation, there being 42 miles of line or 90 miles of single track, not including 7½ miles of siding. The power capacity of the system is sufficient to move fifteen six-car trains per hour in each direction between Flatbush Avenue and Belmont Park; three six-car trains

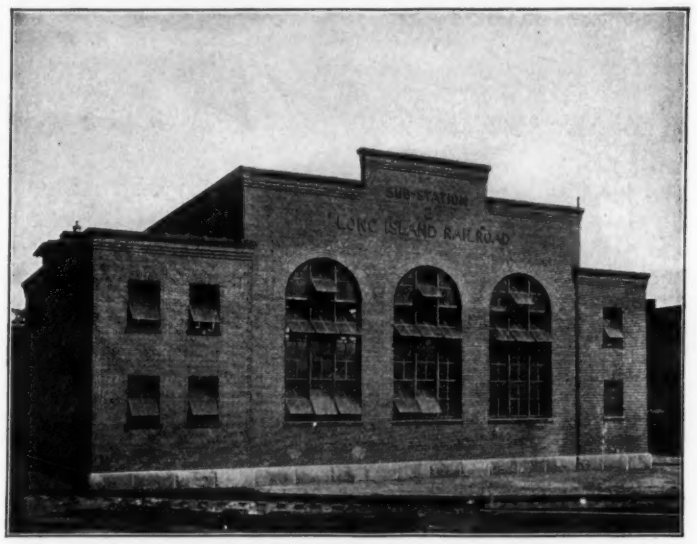


FIG. 1.—VIEW OF EXTERIOR OF EAST NEW YORK SUB-STATION.

per hour in each direction between Flatbush Avenue and Rockaway Park; and two four-car trains in each direction between Valley Stream and Hammels. While this comprises only part of the Long Island system, when the tunnel lines to the borough of Manhattan, now being constructed by the Pennsylvania Railroad Company, are completed, a new set of conditions will be introduced, which will require very considerable extension of the electric service, and will no doubt comprehend at that time all the lines of the company for, say, 25 miles out of both terminals.

A decision upon the character of the equipment and the characteristics of the electrical apparatus involved, a reference to the pos-

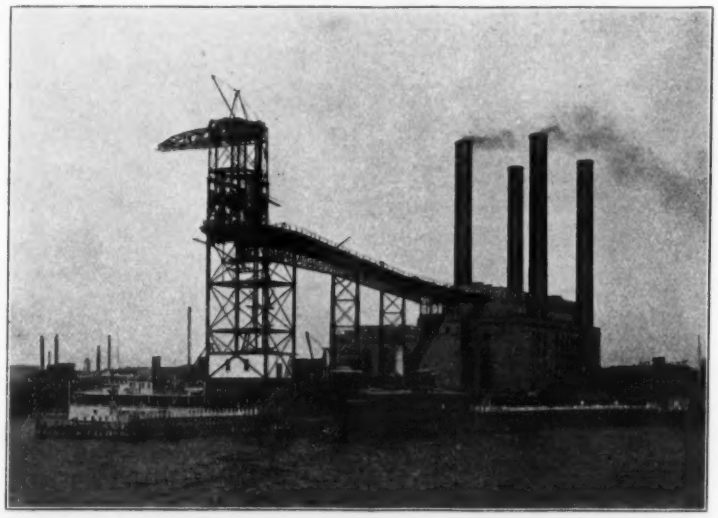


FIG. 2.—VIEW OF LONG ISLAND CITY POWER HOUSE.

sibilities of connecting with the lines of neighboring companies, including the Brooklyn Rapid Transit Company, the Interborough Rapid Transit Company and the Pennsylvania Railroad tunnels, as well as the physical character of the lines of the Long Island Railroad itself. In coming to a decision upon the work, therefore, operation over elevated lines, in subways, on the surface, and also in the Pennsylvania Railroad terminal and tunnels, had to be harmonized. It was decided therefore to adopt for the car equipment

a type and dimension of car which would permit, if necessary, of through operation over connecting lines. It was also decided to adopt a system of electric distribution which was standard on connecting lines, namely, third-rail contact and direct current at 600 volts for the propulsion current, and alternating-current transmission at 11,000 volts for conversion at sub-stations.

Current for the entire system will be generated at the large power house, now nearly completed at Long Island City. This power house will eventually be one of the largest in the world, and has the distinction of being entirely equipped with steam turbines. There are at present installed three Westinghouse-Parsons turbine units, of 5,500 kw capacity each, and the engine room provides facilities for three more such units. It is to be noticed that this power house does not stand at the center of gravity of the electrified system at present, but it must be remembered that the Long Island electrification forms a part of the general scheme for the operation of the Pennsylvania Railroad terminal and the moving of trains in the North and East River tunnels. When all these improvements are in complete operation, and when the western division of the Long Island Railroad is entirely electrified, the Long Island City location will be in about the center of distribution.

The three-phase alternating currents generated at the power house, are carried in conduits through the built-up portion of Long Island City as far as the railroad yards. From here the cables are brought overhead and carried on a specially designed lattice steel-pole line. The construction of this pole line represents an advance over anything hitherto attempted in this direction. The poles are of very strong construction and are mounted on concrete foundations. Wherever the transmission lines cross telegraph or telephone wires, the latter are led underneath the high-tension wires, the very substantial character of the heavy electric cables precluding their breaking and falling across the telegraph wires. A

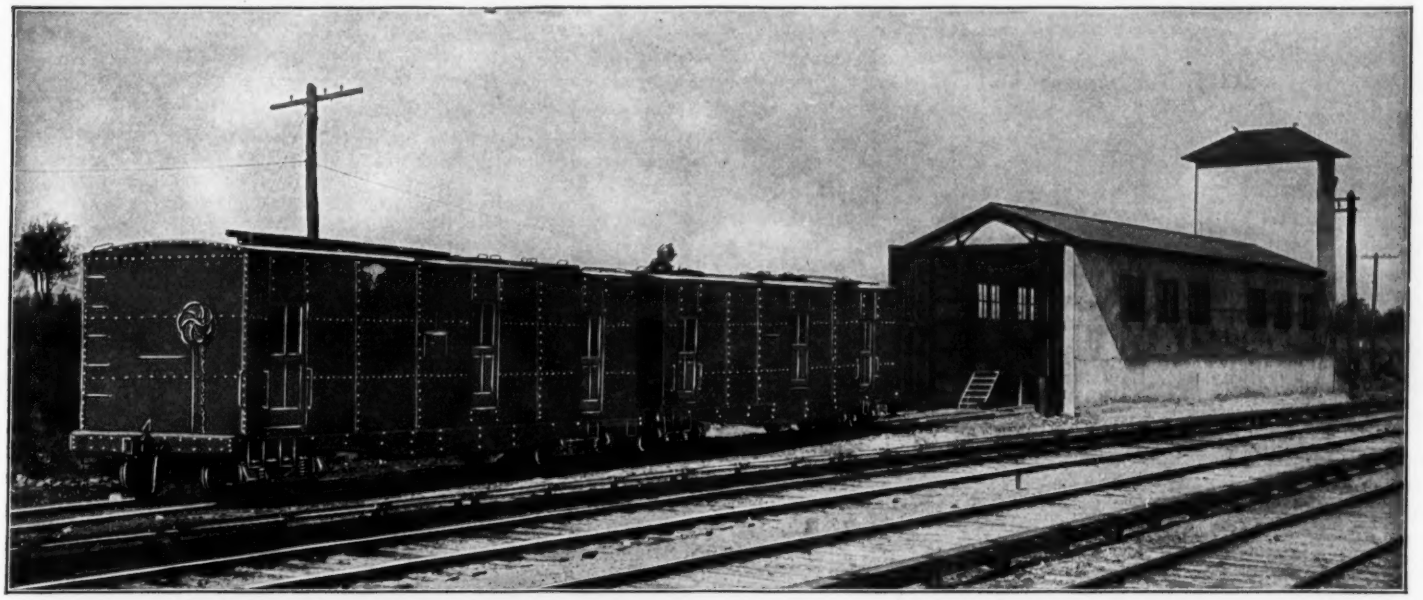


FIG. 3.—VIEW OF TWO PORTABLE SUB-STATIONS AND STEEL AND CONCRETE HOUSE AT BELMONT PARK.

FIG. 4.—VIEW OF ENGINE ROOM FLOOR, SHOWING STEAM TURBO-GENERATORS.

further precaution is taken by having the poles placed closer together at such points.

There are five sub-stations located as follows: Grand and Atlantic Avenues, Brooklyn; East New York, Woodhaven Junction, near Rockaway Junction, Hammel.

As far as possible the sub-stations have been located at junction points, such points being more practicable, as they are the points at which the heavy loads occur. Such locations also make it possible and convenient for the arrangement of transfer switches for the high-tension circuit.

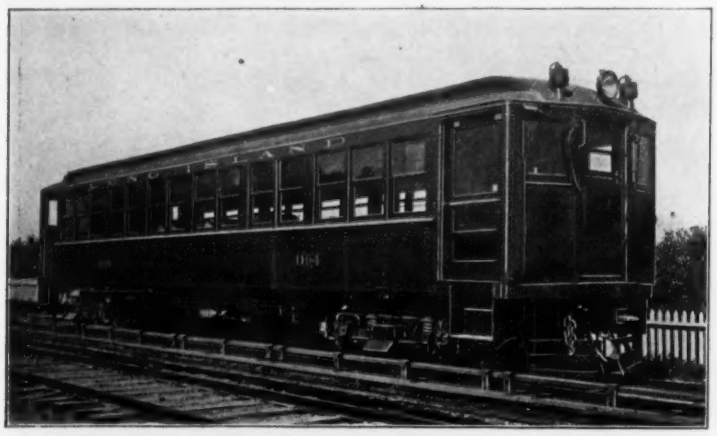


FIG. 5.—VIEW OF STEEL MOTOR-CAR SHOWING CONTACT SHOE PROTECTION.

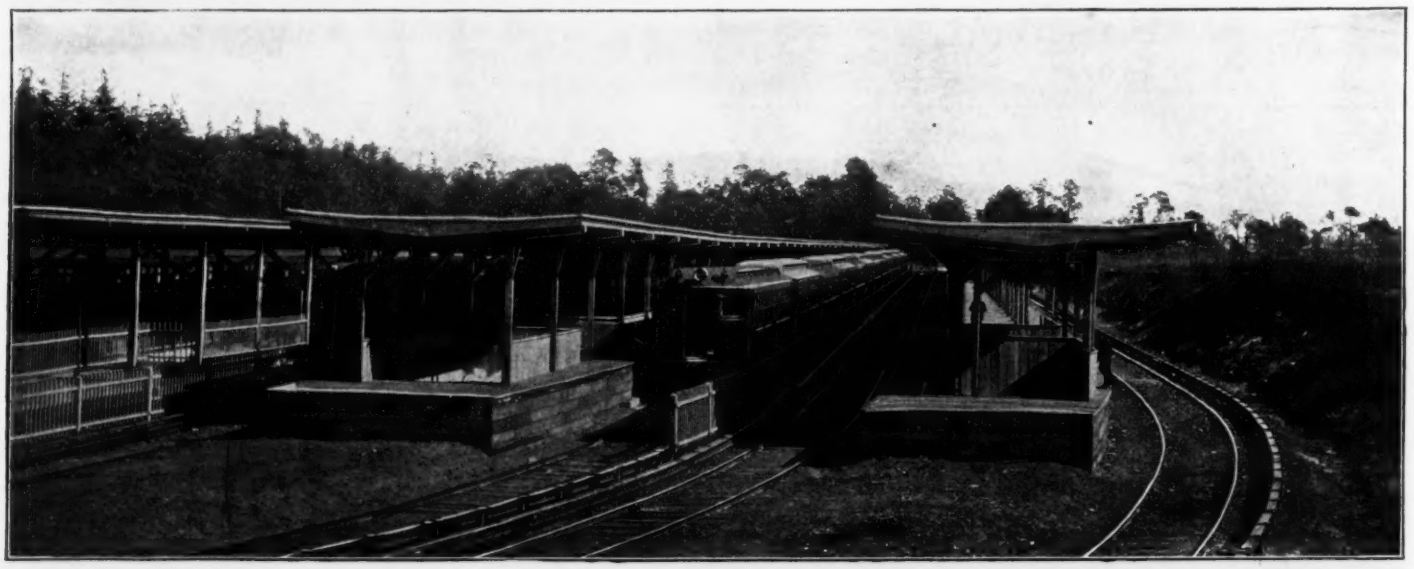


FIG. 6.—TERMINAL FOR ELECTRIC TRAINS AT BELMONT PARK.

The equipment at Woodhaven Junction is the largest of all, being provided with an initial equipment of three 1,500-kw rotary converters and nine static transformers of 550-kw capacity. Ultimately this station will be equipped with six 1,500-kw rotary converters, with a corresponding increase in the number of static transformers.

The Grand Avenue sub-station is provided with an initial equipment of three 1,000-kw rotary converters and nine static transformers of 275-kw capacity. The ultimate capacity, however, will include four 1,500-kw rotary converters, with a corresponding increase in transformer capacity.

The Rockaway Junction sub-station is provided at present with an initial equipment of two 1,000-kw rotary converters and six static transformers of 375-kw capacity. The ultimate equipment will include four 1,500-kw rotary converters and the proper number of static transformers.

The East New York sub-station has an equipment of three 1,000-kw rotary converters, with nine 375-kw transformers, while the ultimate equipment will consist of four 1,500-kw rotary converters and the corresponding number of transformers.

The sub-station at Hammel is equipped with two 1,000-kw rotary converters and six 375-kw transformers. Ultimately, however, it will contain six 1,500-kw rotary converters, with a corresponding increase in transformer capacity. In addition to the above, this sub-station is provided with a storage battery of 2,000-kw-hours capacity, making it the largest storage battery in the world in use for electric railway work. Its installation was deemed expedient owing to the fact that the Hammel sub-station is the farthest from the power station and the transmission line is exposed to an unusual extent, being carried over Jamaica Bay for 4 miles. Furthermore, the load at Hammel is very light during the winter and the very large battery capacity makes it practicable to shut down the rotary equipment for much of the time during the winter months.

All the sub-stations conform closely in interior arrangement, the rotaries and transformers being set up on the first floor, while the main switchboard is placed in a gallery on one side of the building, from which the operators have an uninterrupted view of all the machinery under their control. The high-tension cables are led to a carefully insulated board on the other side of the building facing the main switchboard.

An interesting feature of the sub-station system is an emergency provision for augmenting their capacity to the extent of 1,000 kw through the use of portable sub-stations. These consist of steel cars, each carrying a 1,000-kw rotary converter and three static transformers. Two such portable sub-stations have been built. They were designed primarily not only to reinforce the permanent sub-stations, but to maintain the potential at any points where traction might temporarily be very heavy. Such conditions would be met at the different race tracks, and therefore buildings have been provided at Belmont Park race track and at Springfield Junction, near the Metropolitan race track, where these portable sub-stations may be housed and connected up. One reason for their extensive

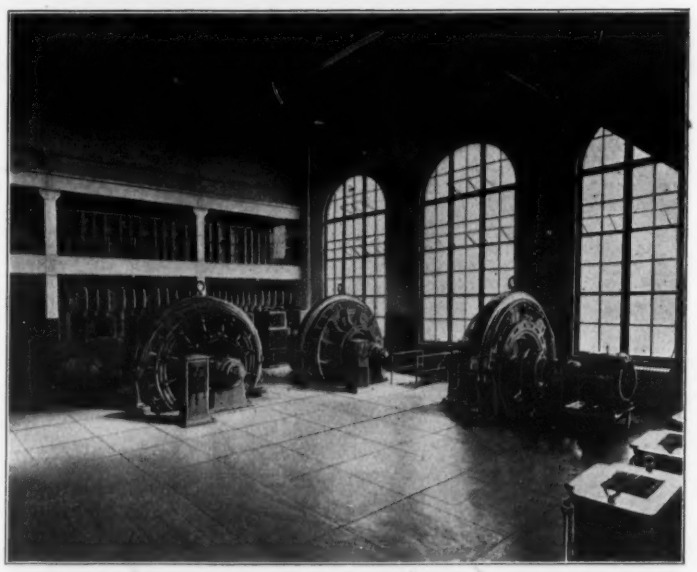


FIG. 7.—VIEW OF INTERIOR OF EAST NEW YORK SUB-STATION, SHOWING HIGH-TENSION SWITCH GALLERY.

use is found in the fact that no feeders are used for supplying the third rail, the high conductivity of these rails permitting of the dispensing of feeders for all ordinary conditions of traffic.

Direct current at a potential of 600 volts is led directly to the third rail from the different sub-stations, and is carried in this way to considerable distances, great care being taken with this third-rail installation to guarantee the safety of pedestrians, and no expense has been spared to attain this result.

The rail is laid at the standard distance from the track rail adopted by this road, the Pennsylvania Railroad and the Interborough Rapid Transit Company, namely, 27 in. from the gauge line of the track to the center line of the third rail, and with top of rail 3½ in. above the top of the track rail. Placing the third rail in this position will allow of interchange between the above-named railroads and will permit of proper clearances for steam equipment, especially the steel hopper cars now in general use. The rail is laid on sleepers, which extend at intervals beyond the line of track, and is supported by insulators made of vitrified clay, and is covered throughout its entire length by a wooden sheathing. Wherever the rail is led in front of stations, a special side sheathing is attached to both sides, making it practically impossible for pedestrians to come in contact with it. Another feature in connection with the protection of passengers at stations is the fact that a running board, similar to the one covering the third rail, is led along the outside edge of the platform, and effectually prevents passengers from coming in contact with the collector shoes of the motor cars.

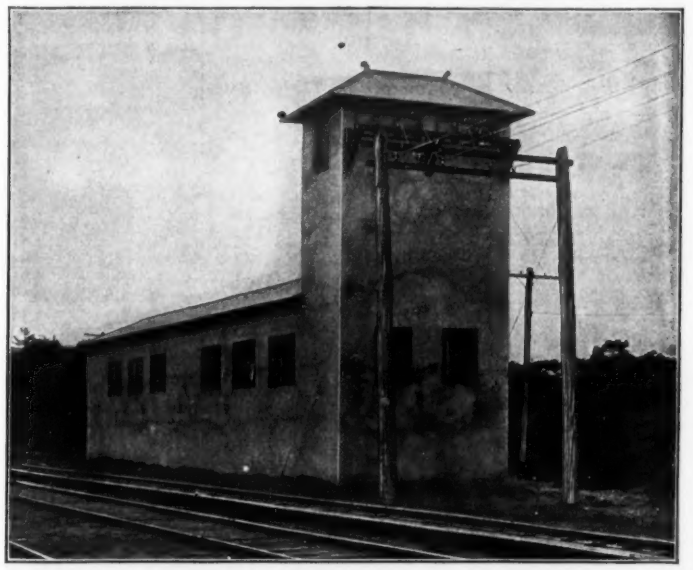


FIG. 8.—STEEL-CONCRETE HOUSE AT BELMONT PARK FOR TWO PORTABLE SUB-STATIONS.

The trains are made up of steel motor cars, of which 130 have already been equipped, and trailers in the ratio of three to two—that is, a five-car train will consist of three motor cars and two trail cars, the motor cars being cars 1, 3 and 5. An eight-car train, however, will consist of five motor cars and three trail cars, the motor cars being 1, 3, 5, 6 and 8, or else Nos. 1, 3, 4, 6 and 8.

All the cars are equipped with the Westinghouse pneumatic multiple-unit system of control, and each motor car has two propelling motors of 200-hp each, both of which are carried on the same truck. Both cars and trucks were designed by George Gibbs, chief engineer of electric traction for the Pennsylvania, New York & Long Island Railroad and for the Long Island Railroad, and were built by the American Car & Foundry Company and the Baldwin Locomotive Works, the cars being constructed by the former company and the trucks by the latter. These cars are quite similar in appearance to the steel cars in use by the New York Subway (which were also designed by Mr. Gibbs), being constructed throughout of steel and finished in aluminum.

These cars are now receiving their equipment at the shops of the Long Island Railroad, which have a capacity for the equipment of about ten cars per week, which are received from the builders in an entirely completed condition as regards exterior and interior finish, but are bare of any electrical apparatus. After receiving their electrical equipment they are given many trial runs before being placed in active service. Each motor car weighs 83,000 lbs., and is capable of maintaining a maximum speed of 55 m.p.h. and a schedule speed, including stops 1.6 miles apart, of 24 m.p.h.

A noticeable feature of their operation is the fact that, although attaining their maximum speed under very short headway, there is no jerk experienced in the process, acceleration being accomplished very smoothly and evenly. The trains are brought to a stop in the same even manner, being equipped with specially designed air brakes controlled by the new Westinghouse graduated release triple valve. In this respect the equipment is a great improvement over any electric trains hitherto tried.

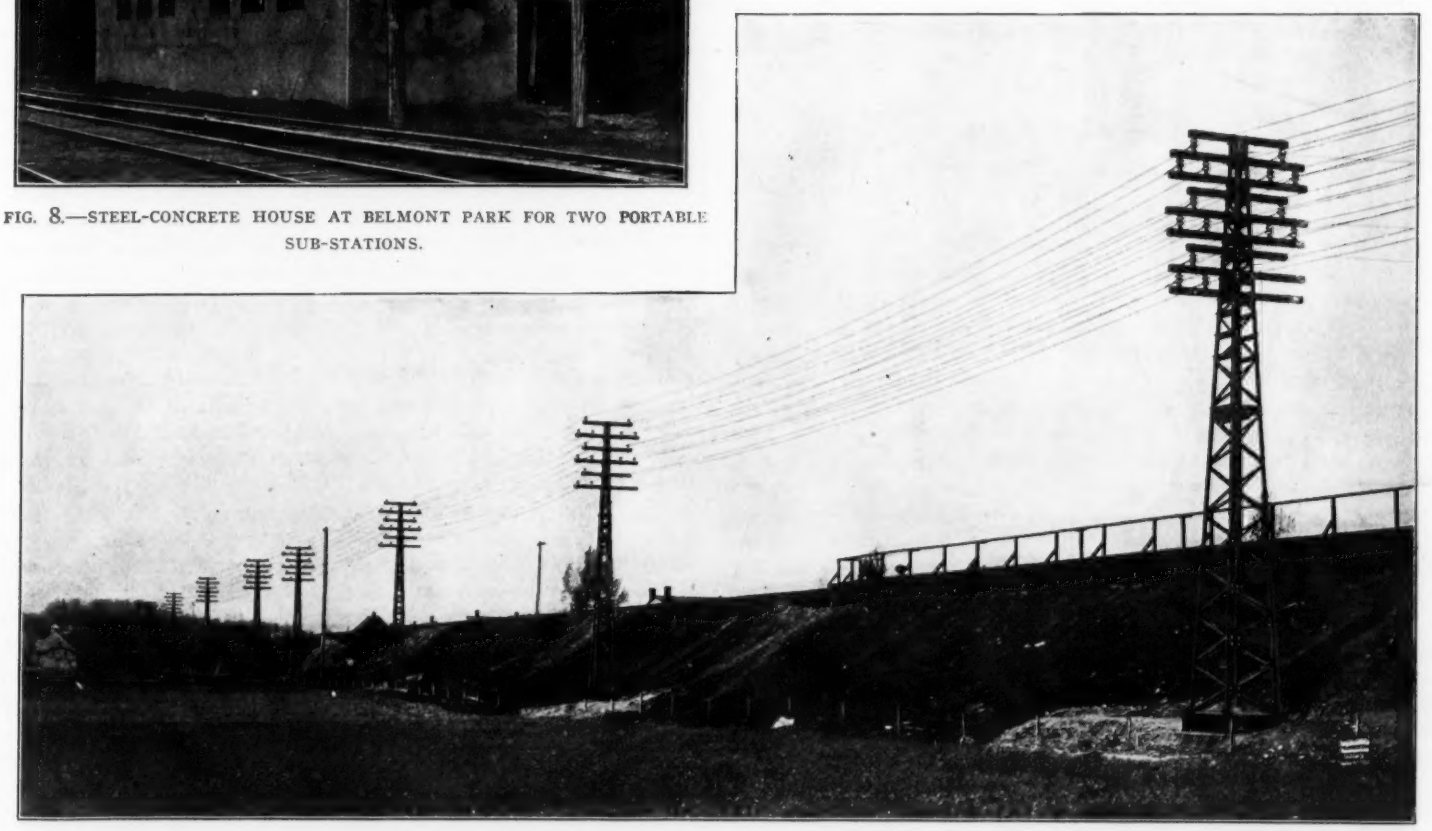


FIG. 9.—VIEW OF TRUNK TRANSMISSION LINE BETWEEN LONG ISLAND CITY AND WOODHAVEN JUNCTION.

When it was decided three years ago to electrify the system, Westinghouse, Church, Kerr & Company were engaged to act as engineers and constructors for the road, the entire work being under the direction of George Gibbs, who acted first as electrical engineer of the road and first vice-president of Westinghouse, Church, Kerr & Company, and afterward as chief engineer of electric traction for the road, the general features of the work being under the supervision of the electrical committee of the road, composed of various officials. The construction work has been under the supervision of George B. Caldwell, who acted as superintendent of that department.

Electrical Equipment of a Buffalo Theatre.

An installation involving some new and rather radical features in the electrical equipment of theatres has recently been made in the new theatre which has been erected on the site of the old Court Street Theatre in Buffalo, N. Y. The new theatre is now known as Shea's Theatre, but was originally intended to be known as the Park Theatre.

Owing to the great amount of illumination desired, and the fact that the space at the command of the owners would not allow of the installation of a private power plant, the question of the system to be used became of paramount importance, the necessity of preserving a balance under all the diverse conditions of this kind of an equipment being thoroughly comprehended. The illuminating company impresses on its commercial lines a potential of 110-220 volts and usually requires a three-wire system. It was finally decided to place the whole installation on a two-wire system, using the 220-volt lines of the company, thus eliminating any question of balance under all conditions. For the accommodation of traveling companies, which invariably carry 110-volt appliances, a subsidiary 110-volt line was run to a duplicate set of bunch pockets located on the stage.

There are over 1,500 32-cp lamps used on the stage alone; six borders of two hundred each, two hundred in the "foots," and a row around the sides and top of the proscenium arch. Those around the proscenium arch are sunk in the arch itself, behind the stucco, and are not visible to the audience. They are installed in such a manner that the light from each side is reflected clear to the front of the stage, on a line with the "foots." It seems to be a desire with some theatre people, monologists especially, to

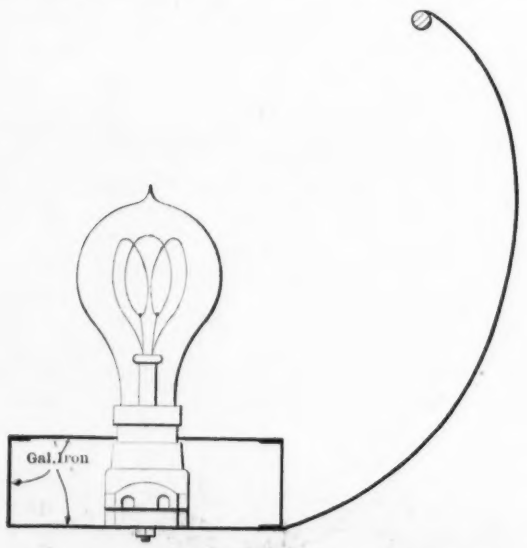


FIG. 1.—SECTION THROUGH BORDER LIGHTS.

get as close to their audience as possible, and these proscenium lights were installed especially to maintain a volume of light on the artist, under these circumstances, a spot or flood light not being acceptable.

Considering the large number of lights in the borders, the question of weight was of moment. The borders are shown in the accompanying drawing, Fig. 1. They are made wholly of medium gauge galvanized iron, black painted outside, and of heavy white enamel inside. The receptacles are bolted to the bottom of the metal trough, the heads of bolts being sealed in, and the nuts soldered on.. All the circuit wiring is laid in the metal trough, and ready accessibility, in case of trouble, is obtained by the removable sectional cover. A new feature is the hanging of the borders as shown in Fig. 2. Six-foot iron rods are riveted to the iron ribs of borders, four to each border. The borders are hung with double lines, fastened securely at gridiron, passing through small pulleys at top of iron rods, thence through sheaves and trimming blocks to a pin rail.

By a glance at the drawing, as shown in Fig. 3, the best effect possible will be seen to have been attained in the footlights. *A* is the drip slot *B* is the hinged cover to wiring trough, and *C* is the hinged reflector that can be thrown back to permit of changing the lamps. The incandescent part of the lamp filament is on an exact line with the floor of the stage, and by the use of the hinged parabolic reflector, an even light is diffused from the floor of the stage to a considerable height.

The stage switchboard is built in a solid box of concrete, access to which is gained by a small iron door at the rear. The front is protected by a heavy grille. Space was a factor, the board

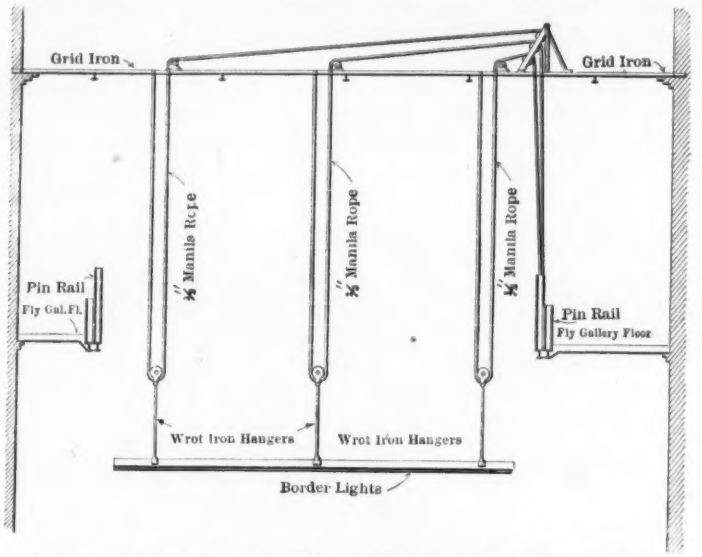


FIG. 2.—ELEVATION SHOWING ADJUSTMENT OF BORDER LIGHTS.

being allowed only 7 by 4 ft. Every light in the building, except those in the lobby, is controlled from this board. The lobby is on a separate service, and there is not a panel board in the house. Owing to the limited amount of space and the heavy equipment, the engineer was confronted with a serious problem. All the switches are fused (the enclosed type being used) on the face of the board, there being absolutely nothing behind the board except bare copper bars. Instead of the alternate blades of switches being of the same polarity, as is usually the case, the blades most closely adjacent in separate switches are of one polarity. The fuses are installed on each side of switches instead of at the bottom.

Fuses with specially constructed terminals have to be used, so small is the available space. The 1,500-amp. fuses on the main switch are mounted one on top of another. All the switches are provided with knob handles of special design, which are placed at right angles to the cross-bars of switches. This is another space-saving arrangement and is specially adapted to quick work by the operator. At the bottom of the various rows is placed an insulated bar which prevents the switch from coming in contact with the one directly underneath, and holds the switch at right angles to the board.

The bus-bars on the back of the board are welded at all bends and angles, no screws or bolts being used, and are so arranged as to be adjustable, i. e., one of several special switches can be easily arranged to control any given set or combination of lights.

The dimmers, which are of the "simplicity" interlocking type, are directly under the switchboard, and, in point of capacity, are the

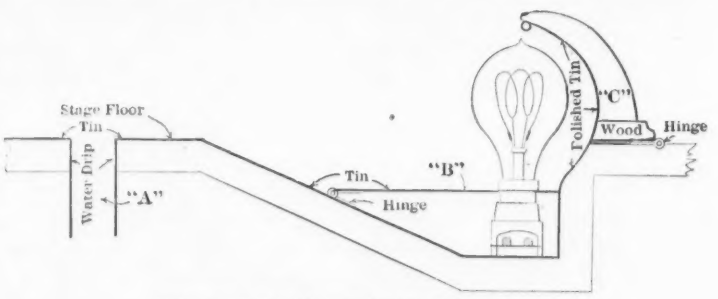


FIG. 3.—SECTION THROUGH FOOT LIGHTS.

largest bank ever made by the Cutler-Hammer Company. Each exit and fire escape light is on a separate circuit, which is carried directly to the service side of the main cut-out underneath the street. These circuits, which are not fused, are controlled by a special switch located in a cabinet in the box office, which is locked when performance begins and only opened in order to throw the switches when the house is cleared.

The exterior illumination is confined principally to a highly or-

nate porte cochére that covers the entire sidewalk. This porte cochére is constructed almost entirely of heavy copper and stained glass, and a myriad of small lamps are ensconced in the tracery of the copper work. Over the copper-tiled roof of the porte cochére is an ornamental double electric sign, bearing the legend "Park Theatre" in 36-in. letters.

The sign is built wholly of heavy galvanized and wrought iron. Edison-base lamps are used, and the screw receptacle shells are soldered directly to the interior iron frame of the sign. Copper bars are run to the center contact points of the receptacle shells, and the iron frame work of the sign carries the return current.

The total installation represents over 5,000 lights, and probably is the largest in this country, outside of New York City.

The theatre is owned by the Shea Amusement Company, which own and operate several theatres in this country and Canada. The electrical equipment is under the direction of Mr. Robert Evers. Mr. John Gray, of New York City, laid out the work and superintended it for the contractors, the McDonnell & Dumond Company, of Rochester, N. Y. Messrs. Leon H. Lempert & Son, the theatrical architects, of Rochester, made the plans and superintended the construction for the owners.

Meeting of the American Institute of Electrical Engineers.

The October meeting of the American Institute of Electrical Engineers was held in the assembly room of the New York Edison Company, on October 27. The general subject of the meeting was "Lightning and Lightning Protective Apparatus," the three papers referred to below being presented on this subject. On the platform with President Wheeler and Secretary Pope were ex-presidents Scott, Steinmetz and Lieb. President Wheeler welcomed to the meeting Mr. W. H. Patchell, of the British Institution of Electrical Engineers, and invited him to take part in the discussion of the papers. Mr. J. W. Lieb directed the attention of the members to a silver tablet which the Italian Society of Electrical Engineers had presented to the American Institute of Electrical Engineers as a token of the appreciation of the hospitality accorded its delegates while guests of the Institute on the occasion of the recent International Electrical Congress.

A paper was presented by Mr. N. J. Neall describing a method of obtaining, by means of test papers inserted between the gaps, records of the operation of lighting arresters in service, and reporting on some results obtained by the use of this method on several transmission lines. The test papers were furnished by the Westinghouse Electric & Manufacturing Company to a number of operating companies about one and one-half years ago, who agreed to investigate this matter under its auspices. The general idea in the distribution of test papers was so to cover the country that the same apparatus at different localities would come under comparison; there was no endeavor to make a thorough comparison of all types of arresters used, chiefly because the selection rested with plants in operation, and the main investigation was to be of the effectiveness of the arrangement of gaps and resistances in the low-equivalent lightning arrester. Incidentally, however, some interesting results were obtained on other types at what happened to be comparable voltages of transmission. The range in voltage of the high-tension plants extends from 6,600 to 55,000, particular interest attaching to returns at 25,000 and 30,000 volts. The tests covered territory extending from Maine to California.

By comparing the holes made by the discharges through the older forms of arrester which have no series resistance, with those made by discharges through the low-equivalent arrester for the same voltage, it was found that no greater difficulty in discharge is encountered, as evidenced by the ragged edges or torn appearance of the holes in the low-equivalent arrester papers. These blister-like holes seem characteristic of free severe static discharges. If a paper is placed in the path of discharge of a high-tension condenser used in the equivalent spark-gap method a blistered hole invariably results. If an element having a high static resistance is inserted in the circuit, this hole is reduced to a fine one with smooth edges. If current continues to pass the hole will be enlarged and badly smoked, but will still have smooth edges. By comparison it is found that the typical static discharge through a carbon pencil type of resistance is of this smooth-bore character, while gaps used without resistance give the blister effects.

A curious effect observed in the plain gap papers shows that the original puncture may be very fine and yet the current once having held over will completely burn it away. On the other hand, the low-equivalent lightning arrester gives evidence of a quicker suppression of the short-circuit arc after the discharge has passed.

The most important information given by these papers is that the lightning disturbances on a line are not of the magnitude generally supposed. The small holes made in paper are substantially the same as those made in insulation, and it is worthy of note that these small holes pave the way for very serious breakdowns of apparatus, due to the current from the generator forming a continuous arc.

A comparison of lightning arrester papers punctured in practice with the papers taken from the idle lines, leads to the belief that the low-equivalent arrester discharges these disturbances almost as freely as if the resistances were omitted.

A comparison of results shows clearly that for freedom of discharge the arresters which are built like the low-equivalent with low resistance have freer discharge than the straight gaps and high resistance.

The action takes place through the series gaps and both of the resistances, and nothing occurs in the shunted gaps unless discharges are of high frequency and are greater than a certain severity. When discharges are found in the shunted gaps, the papers usually show a clean puncture, indicating that the discharge is chiefly static. It seems that the time-element of the disturbances, together with the throttling action of the non-arcing metal multi-gaps, enables the static disturbance to pass before the line current can follow.

Arresters with gaps and resistance capable of carrying considerable current for a short space of time act like high-potential regulators, relieving the line of surges promoted by many causes other than lightning. The papers show the ability of arresters to discharge automatically and repeatedly without attention. They indicate that the discharges at 55,000 volts pass as freely as those at lower voltages.

The paper by Mr. Julian C. Smith on "Some Experiences with Lightning Protective Apparatus" was read by Mr. G. S. Dunn. Mr. Philip Torchio presented his own paper on "Notes on Lightning Arresters on Italian High-Tension Transmission Lines." Abstracts of these two papers are given on page 780 of this issue.

The discussion of the papers was opened by Mr. P. H. Thomas, who stated that much progress had recently been made in lightning arresters and that the requirements for a successful arrester were much better understood than formerly. Commercial arresters at the present time embody two essential details: some form of air-gap and some means for interrupting the arc which the generator tends to sustain when a discharge takes place across the air-gap. In order to assist in rupturing the arc a resistance in the ground wire has been found quite good, but such resistance is not essential to successful operation, and it is, perhaps, not the best protection. For the purpose of ascertaining the behavior of various types of arresters and learning the nature of the disturbances to be taken care of, the method of using test papers as proposed and carried out by Mr. Neall, seems especially advantageous, and it is desirable that record be kept continuously under various operating conditions for several years. Experience has shown that the resistance used with the low-equivalent type of arrester performs satisfactorily the task of carrying off the discharge without injury. The most difficult condition under which an arrester must operate is that due to a direct lightning stroke. Such a stroke ordinarily damages several poles on the line. In order to protect the station from the effects of a direct stroke on the line it is well to place arresters at perhaps one mile from the station so as to remove the charge with sufficient rapidity to prevent an excess of voltage from reaching the station over the line. Mr. Thomas expressed the opinion that a most satisfactory arrester for direct strokes could be found in spark-gaps connected to the ground through long fuses. The one disadvantage of the fused arrester resides in the fact that a single discharge destroys each fuse, and the arrester can again be put into operating conditions only by inserting a new fuse. This disadvantage could be overcome by using several air-gaps, each with a fuse, and adjusting the gaps for different discharge voltages.

Mr. C. F. Scott remarked that a most useful feature of the method used by Mr. Neall resides in the fact that it encouraged engineers to take an active interest in the performance of the arresters and to

gather comprehensive information concerning the lightning discharges. Test papers have been obtained from circuits operating under all conditions of climate and at all ranges of voltages, and from them general conclusions can be drawn. Evidence is conclusive that all so-called lightning discharges are not of the same character, and the requirements of the arresters vary with the nature of the discharge, the circuit voltage, the capacity of the station and the positions on the line. More trouble is experienced on low-tension than on high-tension lines due primarily to the existence of much higher current values with the former lines, the total destruction of arresters depending largely on the current strength.

Prof. W. S. Franklin stated that it is more important to know of the failures than of the successes of lightning arresters, and that the collection of information as to the number of discharges passing through an arrester was of relatively small value. In regard to the Gola arrester described by Mr. Torchio, it is worthy of note that for the extremely high frequency existing in a lightning discharge the iron added as a core to a choke coil does not increase its inductance. The introduction of an abrupt and great change in the section and shape of the line conductors is advantageous only to the extent to which such change produces localized inductance or capacity, which alone can act to reflect the charge. The use of a high-resistance connection to earth is obviously advantageous. What is needed, however, is a surface resistance which will allow the high-frequency discharges to pass freely, but will not appreciably conduct the low-frequency line current. The requirements could best be fulfilled by the use of terra cotta pipe covered with a thin film of current-conducting paint, such as platinum chloride.

Mr. W. H. Patchell, chief engineer of the Charing Cross & City Electric Company, London, related his experience with arresters on 70 miles of 10,000-volt underground cables. The surges which were produced in these cables due to abruptly changing line conditions were not properly taken care of by the plain horn arresters which were installed initially. It was found that when an arrester, set for a discharge voltage of say 16,000, operated, there would be formed a metallic bead which would decrease the distance between the horns to less than that corresponding to normal voltage. A satisfactory arrester was constructed by using a surface of carbon on one of the horns, and adjusting the horns so that the sides were almost parallel for several inches in a vertical direction, a glass box being placed around the horns for the purpose of serving as a chimney to assist in blowing out the arc. The resistance used in series with the arrester consists of glycerine and water, to which has been added a trace of sodium.

Mr. J. H. Hallberg said that not all of the difficulty experienced in the use of lightning arresters could be attributed to the arresters themselves, because frequently they are improperly installed. A recent investigation of the failure of multi-gap arresters on a certain 4,000-volt system revealed the fact that the arrester gaps had been so placed that the lightning discharge found an easier path directly across the terminals than across the gaps. When the terminals were separated and more gaps placed in series, the trouble was entirely eliminated.

Mr. H. C. Wirt, in reply to an inquiry by Mr. Hallberg, stated that the former difficulty which was attributable to the variation in the resistance in series with the arresters when graphite pencils were used, had been overcome by the use of carborundum as a resistance material.

Mr. H. G. Stott remarked that disturbances on the line could be divided into two classes: surges and strokes. The former of these can be taken care of by the use of adequate insulation. In dealing with the latter class the arrester must conform to two conflicting requirements, namely, it must allow the lightning discharge to pass without hindrance, and it must prevent the passage of the main line current. It is impossible for a single device to perform both functions perfectly, and a compromise must be effected.

Dr. C. P. Steinmetz discussed in detail the nature of the disturbances on transmission lines and outlined the requirements for successful arresters. He said that the knowledge concerning the complex phenomena involved in lightning is far from complete. A few general facts may be stated, however. Disturbances may originate from within the system, due to switching, etc., or they may come from the atmosphere by static or magnetic induction or by direct stroke. So far as the line is concerned the effects of these various disturbances are quite similar; they differ in quantity only. Some are of low frequency and high power, others are of high frequency and may be oscillatory in character. A single lightning disturbance may start an oscillatory discharge, a normal frequency power current arc and a low-frequency surge, all operating simultaneously on the same circuits. These effects have not yet been thoroughly investigated. It is worthy of note that the third, ninth and fifteenth harmonics in a three-phase system may combine to produce low-frequency surges. The effects which are produced at the points where overhead wires join with underground cables, remain yet to be studied completely. Experience has shown that while underground cables are subject to internal surges, they are free from trouble from lightning. An overhead system may be rendered immune from external disturbances by placing the wires within a conducting shield. An approximation to the shield is found in an overhead wire connected to ground at frequent intervals. The essential requirements for a successful lightning arrester is the ability to allow the high-frequency charge to pass to ground readily at a voltage somewhat in excess of the normal working value and to prevent the low-frequency current from following the arc at the normal voltage. It has been found that for high-frequency discharges several gaps in series require a disruptive voltage corresponding to the total distance of the gaps. With low-frequency current, however, the striking distance of several gaps in series is more nearly the sum of the striking distances of the individual gaps. It will be seen, therefore, that with multiple-gap arresters, the high-frequency discharge will pass relatively more freely than the current at normal line frequency. The prime object of the series resistance is to prevent the discharge from becoming oscillatory and thus to eliminate the formation of internal surges.

Lightning Arresters.

The paper by Mr. Julian C. Smith, read at the October meeting of the American Institute of Electrical Engineers, dealt with some experiences with lightning protective apparatus which the operating department of the Shawinigan Water & Power Company has had during the years 1903, 1904 and 1905. The power is delivered through a double set of bus-bars to the low-tension side of the step-up transformers. These transformers are T-connected for transforming from two-phase to three-phase. The ratio of voltage transformation is 2,200 to 50,000. The neutral point of these transformer banks is grounded, giving about 29,000 volts between each wire and earth.

In 1903 only the No. 1 Montreal line was operating. This line connected the generating station at Shawinigan Falls, Province of Quebec, with the Montreal terminal station, situated just outside the city of Montreal. The distance from the generating station to

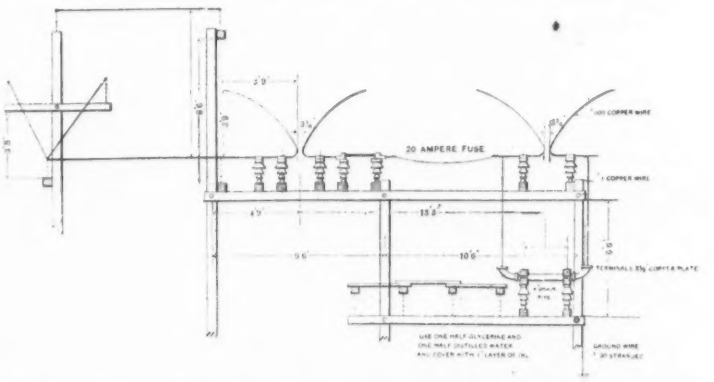


FIG. 1.—HORN LIGHTNING ARRESTER AND RESISTANCE.

the terminal station is 85 miles. The transmission cables are supported on 35-ft. poles, with cross arms 6 ft. long fastened with through bolts. The top of every pole is bored to receive a pin. All pins are 18 in. long and were boiled in stearine. It is to be noted that the whole load of the long-distance line consists of synchronous apparatus, and that by properly regulating the fields of this apparatus the power factor can be kept at unity.

In the fall of 1904 the No. 2 Montreal line was completed. The No. 2 line is parallel to the No. 1 line for nearly the entire distance, and in most places is not more than 100 ft. distant. The second line is similar to the first except for the fact that a ground wire is strung along the line at the neutral point of the triangle. This

ground wire is connected to the earth at each pole by a wire running down the pole.

When the No. 1 line was put into service the lightning apparatus installed was as follows: At each end of the line was a bank of Westinghouse lightning arresters of the low-equivalent type and a bank of static interrupters. The number of gaps in these arresters was decided upon only after a series of tests had been made to determine the lowest practicable breakdown voltage. These arresters were set to discharge at about 65,000 volts. In 1904 a bank of General Electric arresters was placed on the 50,000-volt line in the Joliette sub-station. This bank was also adjusted to discharge at about 65,000 volts. In 1904 three banks of horn arresters were put on the No. 1 Montreal line. These arresters consist of bent copper rods. The horns were spaced 6.25 in. apart at the gap, this distance corresponding to a breakdown voltage of 90,000. In 1905, when the No. 2 line was equipped with lightning arresters, three banks of low-equivalent arresters were put in, one at each end and one at Joliette. In addition to these arresters three banks of the 1905 type of horn arresters were put in.

As stated above, the only line in operation in 1903 was the No. 1 Montreal line. That line was protected by low-equivalent arresters at each end. During the summer of 1903 several disturbances occurred, which may be summarized as follows:

1. Poles splintered by heavy discharges. 2. In a few instances insulators broken. 3. Flashes across the static interrupter terminals. 4. Arcs on the transformer terminals. 5. Arcs inside the transformer cases at the top between adjacent leads. 6. Damage to apparatus caused by 3, 4 and 5. 7. Interruption to service, due usually to excessive voltage drop, causing synchronous apparatus to fall out of step.

In view of these disturbances and damage it was decided to put in a type of horn lightning arrester affording a low resistance path to ground, to depend on a fuse for the interruption of the short-circuit which would occur if the horns did not break the arc, and to set these horns so that only the heavier discharges would break them down. The horns were consequently adjusted to discharge at about 90,000 volts.

At the end of 1903 it was determined that the arresters installed were sufficient to meet the conditions caused by ordinary storms. They protected the line from abnormal rises of potential due to switching or short-circuits; but in those cases when the lightning stroke damaged poles on the line the rise of potential was so high and took place so rapidly that the arresters could not carry enough current to keep the potential of the line within safe limits. The horns installed were especially designed to take care only of the disturbances which the standard arresters could not handle.

In 1904 there were more than the usual number of storms. On the following dates the horns discharged:

Date.	Shawinigan.	Joliette.	Montreal.
July 11	3 horns	1 horn	None
August 5	2 horns	3 horns	None
September 20	2 horns	2 horns	None

During 1905 the number of storms was less than usual, but there were two very violent storms, both near Shawinigan. Poles on the No. 1 line were damaged. At various times during the summer the horns of both lines discharged, but it is noteworthy that the horns of the two lines did not discharge at the same time; that is, the two lines only about 100 ft. apart would not be equally affected by lightning discharges.

The horn arresters on the No. 2 line were designed to take less current than those on the No. 1, as a resistance consisting of a mixture of glycerine and water was put in the ground connection; in parallel with this resistance was a horn gap. During the first storms it was noticed that the resistance had "an equivalent spark-gap" greater than the horn, although the resistance was about 10,000 ohms and the gap about three inches. The resistance was greatly decreased early in the summer by pushing the terminals closer together and the gap was slightly increased. After this was done the lightning discharge went through the resistance.

Another factor came into play in 1905. The two long-distance lines are operated in parallel on the low-tension sides at both ends. As stated previously, the neutral point of the transformer banks is grounded at Shawinigan. A series transformer was placed in the ground wire leading from each bank of transformers, and an overload relay connected to this series transformer, so that if any considerable amount of current flowed into the neutral the relay would open up the low-tension side of all of the transformers connected to that line. The operators in the Montreal terminal station were depended upon to separate the two lines in cases of trouble. By this means a ground or heavy disturbance on one line would cut that line out of service. The experience during the past year showed that this scheme works satisfactorily. To some extent, however, it masks the action of the lightning arresters, as in case of heavy discharges over the horns the relay would cut off the line.

Summing up the experience with reference to the horns, the author stated that they were considered a valuable addition to the standard equipment. Since the installation of the horn arresters there have been no arcs in the station. No damage has been caused to the apparatus. No interruptions to the service have been caused directly by lightning. On the other hand, each time the horns discharged a more or less severe short-circuit occurred, in no case, however, being severe enough to cause trouble or to cause the synchronous apparatus to fall out of step.

The paper by Mr. Philip Torchio described lightning arresters in use on Italian high-tension transmission lines. Details are given of the so-called "series lightning arrester" of Gola and the "water-resistance static discharger" of Friese.

It is claimed by Gola that the shortcomings of the ordinary commercial lightning arresters are due to some deficiency in the choke coils employed and not to any deficiency in the lightning arresters themselves, their function being only to discharge the line. To overcome the shortcomings of such choke coils, Gola devised an apparatus in the shape of a large shell, consisting of a choke coil and a number of large cast-iron diaphragms and shells connected in series by means of small copper conductors, the whole being placed in series on the line to perform the functions of a choke coil, and also to introduce an abrupt and great change in the section, material and shape of the line conductors leading to the station apparatus. The device is ilustrated in Fig. 2. In proximity to the sharp-edged

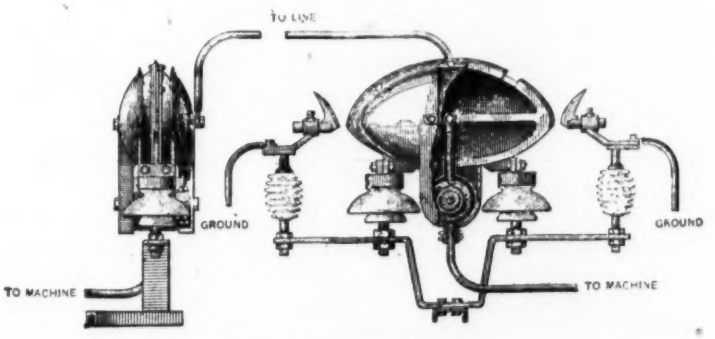


FIG. 2.—GOLA ARRESTER.

ends of the shell are located corresponding air-gap, horn-shaped lightning dischargers which are connected, through a resistance to ground, either directly or in series with ordinary lighting arresters, according to the requirements demanded by the line voltage. The functions of the supplementary lightning arresters is to assist the main air-gap in rupturing the arc after the lightning discharge has taken place. It is claimed that while this device will allow the main line current to pass undisturbed, it will so obstruct the passage of lightning or static discharge currents as to cause them to be reflected at this point and pass to ground via the dischargers above mentioned. This obstruction is claimed to be due to several effects of discontinuity of the circuit.

The "water-resistance static discharger" is connected at each end of the line, one discharger between each conductor and ground, thereby forming a permanent continuous path to ground for a small fraction of the main line current. A general feeling prevails that this grounding will eliminate a great many troubles from lightning and surges on the line. Several ways of grounding the line are in use in Italy, but the one at the Morbegno station of the Valtellina three-phase railway may be considered as representative of the water-resistance type of grounding device. The device is mounted on an iron frame outside the station. It consists of grounded feed and discharge water pipes supplying the necessary water to three pairs of glass tubes, each pair being joined at the middle by a metallic union to which are brought the grounding connections from the line conductor; the grounding is made through the two water tubes in parallel. The current to ground in this system, operating at 20,000 volts (11,000 volts to ground) is 0.2 amp. from each line wire

to ground. The superintendent of the station was hopeful of the success of the device.

At the Paderno station of the Milan Edison Company a different arrangement of water-resistance static discharger was being installed at the time of the writer's visit. It consisted of only three large glass water tubes, but of greater diameter and length than those used in the Morbegno station. In this case it was also expected that the device would give satisfactory results.

The best practice of to-day for the protection of Italian transmission lines indicates that the plan illustrated in Fig. 3 should be adopted. The plan shows that:

1. The terminals of the transmission lines should be extended in a direct line some distance away from their entrance into the station,

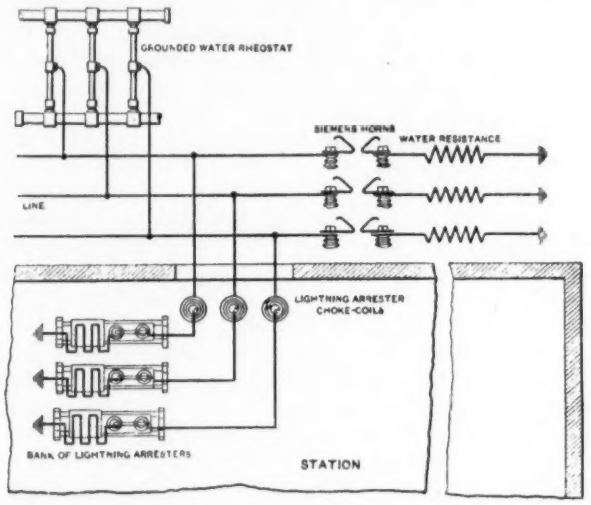


FIG. 3.—WATER-RESISTANCE STATIC DISCHARGERS AND HORN ARRESTERS.

and the ends should be equipped with Siemens' horn arresters grounded through water resistances.

2. On the line side of the branch entering the station a water-resistance static discharger should be installed.

3. Choke coils and ordinary lightning arresters should be installed inside the station. Possibly choke coils of the series lightning arrester type should also be added.

4. Siemens horn arresters should be used on the poles along the line only after careful study of the installation. Series lightning arresters, with Siemens horn arresters, or ordinary lightning arresters may, however, be installed at particular points; as, for instance, where a line divides into branches or at special points of a line installed in a mountainous country.

New Telephone Patents.

SUBSCRIBER STATION APPLIANCES.

For a long time subscribers' sets such as are now used were perfectly satisfactory, but now for many purposes a set reduced to a minimum size will alone meet the requirements. The size of the various parts has been reduced, and they have been mounted together most compactly. Now Mr. C. E. Egan proposes to go a step further by combining several functions in one device, and to this end he dispenses with one of the usual ringer coils and mounts in its stead about the leg of the case a rolled type condenser. The remaining coil he provides with a tap intermediate of its ends, and by this means uses a short length of this coil as the indicating coil of his talking circuits. He has obtained two patents covering his system and has assigned them to the Egan Electric & Telephone Manufacturing Company.

What may be termed a "tell-tale" has been patented by A. L. Peterson, of Clipper Mills, Cal. This takes the form of a gravity drop to be mounted upon the front of a bell box with its trigger in position to be released by the bell hammer whenever this is vibrated. Such a drop will show that a call has come in even when a number of bells are in proximity and thus cause confusion of their sounds.

W. N. Clark, of Warren, Ohio, has invented a receiver-supporting arm for desk sets. The arm support is secured to a base, to which the desk stand may be clamped, the supporting arm, built upon the principle of the jointed gas bracket, carries the receiver.

TRANSMISSION SYSTEMS.

Mr. John C. Barclay, of New York City, has endeavored to overcome the attenuating effects of the normal cable by the distributed shunt method. His shunts are tapped to earth at intervals, and consist of high-resistance, non-inductive graphite filled capsules. To absorb the inductive effects of adjacent wires upon each other, Mr. Barclay distributes throughout his cable neutralizing conductors, which are dead-grounded at short intervals.

Another and entirely different method of bettering transmission is that of I. Kitsee, of Philadelphia. Mr. Kitsee strives to reduce the impedance of the talking circuit by shunting the induction coil secondary across the line. This is the gist of one of his patents. Another describes the use of an extremely high potential introduced upon the line to carry to a great distance with very small current, and the receivers at the two stations bridged off the line, each in series with an artificial line proportioned to the transmission line.

LETTERS TO THE EDITORS.

The Place of the Single-Phase Railway.

To the Editors of Electrical World and Engineer:

SIRS:—I wish to show my appreciation of an article written by Mr. Frank J. Sprague in your issue of October 21, entitled the "New York Central-New Haven Electric Traction Situation." Certainly our best engineers will concede that the single-phase railway in its present state of development has but one place, namely, on interurban lines of moderate length and with infrequent stops.

Although there are several single-phase roads which have been in "successful" operation in this country for the past few months, I doubt if all parties concerned would class them as entirely satisfactory. It seems to me that if the same attention were paid the direct-current series motor as has been given the series alternating, we would achieve far greater results. With slight changes in our present car equipment we could easily use an e.m.f. of 1,150-volt direct-current, or by connecting four motors in series (the motor, of course, requiring special insulation), an e.m.f. of 3,000 volts could be used. There would be no change in commutation, and only one form of car equipment would be required, all of known high efficiency and perfectly reliable. By special field winding it would be a simple matter to run at half speed in the cities on low trolley voltages and still retain a high efficiency.

With the advent of the steam turbine we may look forward to even greater developments in the direct-current line, and it is safe to predict a direct-current series motor of 1,100 volts or more with commutation even better than the present low voltage single-phase series motor.

It does seem to me a shame to discard a motor which is so ably suited for just this class of service for one which at the present is only a makeshift until something better turns up.

European countries have successfully used high-voltage direct-current for some time, and the results they have attained we can not only duplicate but develop still higher. Now that the gasoline motor car in interurban work has come upon the field we must be up and doing or be taken off the turf. What the public wants is something better, not something just as good, and I do not see this in the series alternating system.

BIRMINGHAM, ALA. R. B. TENNEY, JR.

The Place of the Illuminating Engineer.

To the Editors of Electrical World and Engineer:

SIRS:—Your editorial entitled "Illuminating Engineering," in your issue of October 21, will, I am sure, go far toward awakening an interest in a branch of engineering, the importance of which has just begun to be realized.

Generally speaking, the one great difficulty that has stood, and still stands in the way of placing interior illumination upon a scientific basis, is that the architect takes it upon himself to handle the question of illumination. The architect decides upon the character and amount of illumination required for any given purpose, and prescribes the location of outlets for the light sources; he often designs the lighting fixtures and selects the glassware for them and deter-

mines how far the fixtures shall be dropped from the ceiling or how far they shall project out from the walls. In short, so far as the question of distribution of illumination is concerned he specifies practically everything.

Going one step further, he often lays out his own lighting plant and draws specifications for wiring, etc. Even when he employs a consulting electrical engineer to do this latter work, the engineer's duties cease at the wiring outlets that are prescribed by the architect.

This condition of affairs is largely responsible for the wasteful or improper illumination that is now the rule rather than the exception. It is therefore apparent that before the art of illumination can be placed upon a sound basis, the problems which heretofore have been handled exclusively by the architect must be placed in the hands of the illumination engineer. The task of bringing about this change will be a difficult one for the reason that the architect as a rule feels that he is fully capable of solving these questions for himself. The question of illumination has been left to him in the past and he sees no reason why it should not be left to him at present and in the future. An awakening is, however, taking place.

During the past six months I have personally interviewed a great many architects on this subject, and although in many cases I have found myself "bucking up against a stone wall," on the whole the results of my campaign in the cause of illumination engineering have been decidedly encouraging.

Only a few weeks ago one of the most prominent architects in the country, by whom I have been retained, stated before a body of engineers, that the time had come when the question of illumination must be turned over by the architect to the illumination engineer. Up to a few months ago this architect had in all cases handled the question of illumination himself.

I do not for one moment wish to be understood to advocate the wresting of the entire question of illumination from the hands of the architect. On the contrary, I am of the opinion that the best results can be secured only by co-operation between the illumination engineer and the architect. By such co-operation the most desirable combination of scientific and æsthetic illumination may be attained.

NEW YORK CITY. LOUIS B. MARKS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

1,500-Volt Direct-Current Traction Motor.—RIKLI-KEHLSTADT.—An illustrated description of 1,500 to 1,700-volt motors for traction on narrow-gauge roads, built by J. J. Rieter & Co., in Winterthur. The difficulties with respect to sparkless commutation and to perfect insulation are stated to have been completely overcome. The following data are given: Gauge, 1 meter; wheel base of truck, 1.80 meter; wheel diameter, 840 mm.; normal voltage, 1,500; power for continuous operation during one hour, 75 hp (at axle); number of revolutions, 430 per minute; weight, including gear case, 1,750 kg. The construction is in general the same as in an older motor of the same firm for lower voltages. The necessity of providing an absolutely sufficient insulation reduces, of course, greatly the available space on the armature circumference. With three segments per armature slot the motor capacity would have been reduced too much; it was, therefore, decided to use five segments per slot. With increasing number of segments per slot the commutation becomes more difficult, not so much on account of the mutual induction of the armature conductors placed in one slot, as on account of the different position of the coils in a slot to be commutated at a moment with respect to the external field. The author says that the use of special commutation poles did not seem advisable. He therefore provided a large neutral zone, the ratio of pole arc to pole pitch being 0.67. By employing a high flux density, especially in the armature teeth and by specially constructing the field coils, the external field is rendered very stable. As shown in Fig. 1, the field

FIG. 1.—FIELD COIL.

magnet coil is turned up on either side so as to fit closely to the armature circumference in the neutral zone, whereby some sort of compensation of the armature field is produced. The insulation was made very carefully, so that a testing voltage of 6,000 to 7,000 between winding and frame could be applied. The main dimensions of the motor are: Armature diameter, 440 mm.; armature breadth, 220 mm. (including a ventilation slot of 10 mm.); number of slots, 53; number of segments, 265; diameter of commutator, 360 mm.; useful breadth of commutator, 90 mm.; motor resistance at 70° C., 2.65 ohms. It is stated that the motor runs absolutely sparkless below 90 hp and at 90 hp small sparks occur at times. Even when at full power 28 per cent of the armature current was shunted away from the field coils, there were no sparks; and this shunt circuit could be switched in or out any number of times, without producing sparks. Fig. 2 gives the characteristic curves of the motor at 1,500

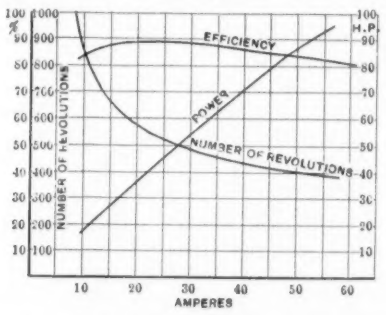


FIG. 2.—CHARACTERISTIC CURVES OF MOTOR.

volts. Even at 1,700 volts and 90 hp the behavior of the motor was perfectly satisfactory. Although it was not tested at higher voltages, the author says there is no reason why the motor should not be considered safe at 1,800 to 2,000 volts. With the shunt connection mentioned above, shunting 28 per cent of the current, the speed increased 12 per cent with constant torque. At times of heavy traffic this would be sufficient to make up for delays. When operated for a full hour at 75 hp, the increase of temperature (over that of the atmosphere) was 72.5° C. in the armature iron, 62.5° C. in the field coils and 44.5° C. in the commutator.—*Elek. Bahnen,* September 23.

LIGHTS AND LIGHTING.

Tantalum Lamp.—WEDDING.—An account of an experimental investigation. The distribution of light was determined for a 25-cp tantalum lamp, consuming 0.3625 amp. at 110 volts. Since the arrangement of the filament with respect to the vertical axle is sym-

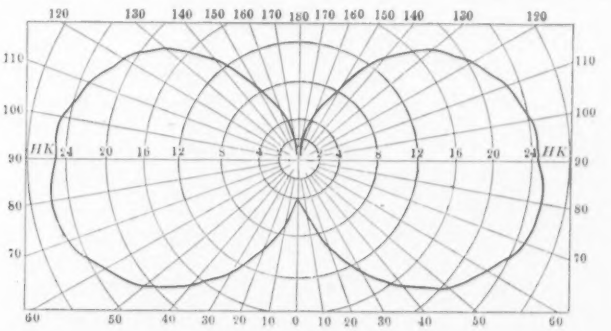


FIG. 3.—DISTRIBUTION CURVES.

metrical, it is sufficient to determine the distribution of light in one vertical plane. The results are given in Fig. 3. The mean spherical candle-power is 191.3. Since the lamp consumed 39.82 watts, its specific power consumption is 2.065 watts per spherical candle-

power, and 1.6 watt per horizontal candle-power. The author determined by a bolometric method the ratio of energy of radiation within the visible spectrum to the total energy of radiation in horizontal direction; the visible radiation was 3.554×10^{-4} watts. The total radiation, 42.72×10^{-4} watts. He then carried out a life test with four 25-cp tantalum lamps in comparison with four 25-cp and four 16-cp carbon-filament incandescent lamps. (In this abstract candle-power means hefner candle; 1 hefner cp = 0.88 British cp.) The results are given in Fig. 4. In the curve of the

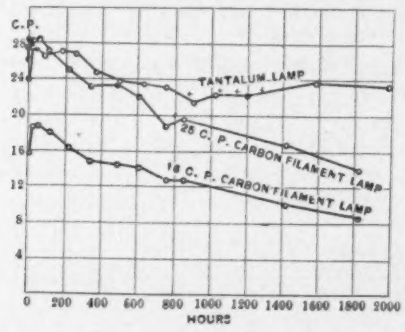


FIG. 4.—LIFE CURVES.

tantalum lamp the filaments of the four lamps broke after 886, 1,030, 1,126 and 1,283 hours, respectively (the points are indicated in the curve by small crosses), the mean being above 1,000 hours. However, this breaking of filament did not terminate the usefulness of the lamps, since the ends of the broken filament easily weld together again. The filament then gets shorter and the candle-power increases. The author remarks that the tantalum lamp has not a "useful" life in the same sense as the carbon filament lamp; the usefulness of the carbon filament lamp is determined by the real life. If the real life is considered not to end with the first breaking of the filament, but to continue as long as the lamp gives light, the mean life of the four lamps is 1,866 hours. The author finally makes a comparison of the economy of the tantalum lamp and the carbon-filament lamp. The former costs $1, the latter $0.125; but the former consumes less power than the latter. The exact comparison for four lamps in each case is given in the curves of Fig. 5 on

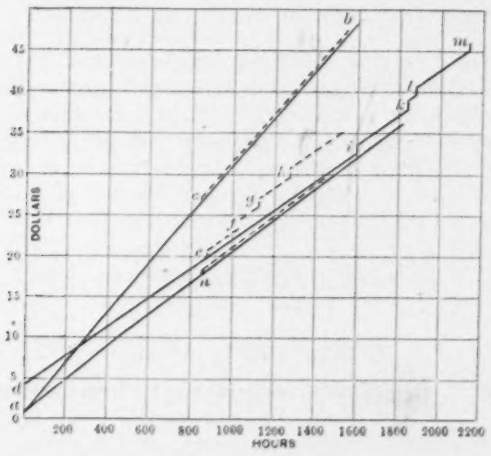


FIG. 5.—CURVES OF COST ELECTRICAL ENERGY.

the basis of the price of 10 cents for 1 kw-hour. The abscissæ represent hours of life, the ordinates total cost; i. e., sum of first cost and cost of electrical energy. The curve *d e f g h* refers to the 25-cp tantalum lamp. At *e* the filament breaks the first time and the lamp is assumed to be replaced by a new one. If, however, the ends of the filament weld again together, the curve becomes *d e i k*. The curve *a c b* refers to the 25-cp carbon-filament lamp. It will be seen that after 270 hours the tantalum lamp is the more economical. The curve *a n* refers to the 16-cp carbon-filament lamp. In compariing the curves *d e f* and *a n*, therefore, no account is taken of the fact that the former (tantalum) refers to 25 candles, practically throughout the whole life, and the latter (carbon-filament) to 16 candles, and that only at the start.—*Elek. Zeit.*, October 12.

Tantalum Lamps.—ZINGLER ("For Siemens Brothers & Co., Ltd.").—A communication stating that the present tantalum lamp when used on alternating-current circuits is not as good as on direct-current circuits, the life of the lamp frequently being considerably shortened and the globe showing a tendency to blacken. It is recommended that the use of tantalum lamps for the present should be restricted as far as possible to direct-current circuits. The candle-power of the commercial lamps of various voltages are proportional to the standard candle-power (23 candle-power) of the 110-volt lamp. "We have had many inquiries as to why we do not put the 110-volt lamp on the market with a candle-power somewhere about 16, the general opinion being that 23 candles was too high for most requirements, although the current consumed is actually less than for the 16-cp carbon-filament lamp. According to present manufacturing arrangements, in order to reduce the candle-power, it is necessary to have a lower voltage lamp, so as to secure the same high efficiency. We are now prepared to accept orders for 2.2-watt lamps for pressures of 50, 55, 60, 65, 73-75, 100 and 110 volts. These lamps have a useful life of about double that of the lamps described above, and give 30 to 40 per cent less light, with a consumption at starting of 2.2 to 2.4 watts per candle-power. For instance, the 110-volt lamp of this type gives a light of about 14.5 candle-power with a consumption of 2.2 watts per candle-power. Its useful life is about 800 to 1,000 hours, and the total life often reaches 1,500 to 2,000 hours. With the consumption mentioned, a lamp having such a long useful life is a great improvement on anything that has been produced in connection with carbon-filament lamps."—Lond. *Elec.*, October 13.

Domestic Electric Lighting.—SWINBURNE.—An abstract of a lecture delivered at the Olympia Electrical Exposition in London. Concerning the relative cost of electric light and gas he stated that without taking into account the cost of lamps, electricity at 6 cents per kw-hour is equal to gas at 50 cents per 1,000 cubic feet. "The gas people were very 'cocky' because they had invented things they called mantles which, instead of giving 12 candles for 5 cubic feet per hour, or something of that sort, gave about 18 candles per cubic ft. per hour when new, and the result was that on this comparison every cent per unit paid for electrical energy corresponded to about 75 cents for gas, and thus electricity at 6 cents could correspond to gas at $4.50. Of course, this comparison was a misleading one; it applied only whilst the mantles were new, and the mantles deteriorated quickly. The question of dirt was also an important factor in a comparison of electricity and gas. In London a house required redecorating once in four years under ordinary conditions of gas, and coal fires. With electricity this could be increased to once every five or six years, so that the amount saved in this way would pay for the redecoration of the house in 20 years. He had worked this out, and he arrived at the result, that, even with free gas, it would be cheaper to take the electric light in the long run."—Lond. *Elec.*, October 13.

POWER.

Power Transmission.—ESSON.—The first part of his presidential address to the Civil and Mechanical Engineers' Society on the influence of electricity on power engineering. He gives an historical review of the subject. Concerning the high-tension series and direct-current transmission system of Thury he speaks as follows: "A system showing such strong vitality, though working on what nine-tenths of our engineers would call antiquated lines, cannot be dismissed in a sentence. The facts are that the system is going ahead in the face of the three-phase alternating system, and is successful on a scale commensurate with many of the larger three-phase installations. The Americans say that the success of such a system would be impossible in their country because the motors would not there get the careful and skilled attention given to them on the continent. This may be so, but with a large plant and sub-stations the objection need not hold."—Lond *Elec.*, October 13.

Power Distribution in Lancashire.—A fully illustrated description of the Lancashire Electric Power Company's system of generation and distribution. The power house as it stands to-day is only the nucleus of what is to follow, and it is intended that it will be increased to many times its present size in a very short time. The system is the first one in England to work with 10,000-volt overhead bare conductors. As far as generation is concerned, there is practically no difference between the plant of the Lancashire and the one recently opened by the Yorkshire Company. The load of both plants will consist of a mixture of mills, collieries and bulk supplies to local authorities. However, in Lancashire, tappings are taken directly from the duplicate 10,000-volt mains to the consumer's premises, and the e.m.f. is there transformed down directly to the voltage required. In Lancashire the 10,000-volt

feeders are taken to sub-stations where the pressure is reduced to 2,000 volts to supply consumers at this voltage.—Lond. *Elec.*, October 13.

Pumps.—HERZOG.—A very long and profusely illustrated description of Sulzer high-pressure centrifugal pumps.—*Elek. Bahnen*, September 14.

TRACTION.

1,500-Volt Direct-Current Traction.—RIKLI-KEHLSTADT.—The road from Bellinzone to Mesocco in Southern Switzerland is to be operated by direct-current at 1,500 to 1,600 volts. Each motor-car will carry four 1,500-volt motors (see the description above in the abstract under Dynamos, Motors and Transformers). The motors are able to haul a maximum load of 60 tons up a grade of 6 per cent with a speed of 20 kilometers per hour.—*Elek. Bahnen*, September 23.

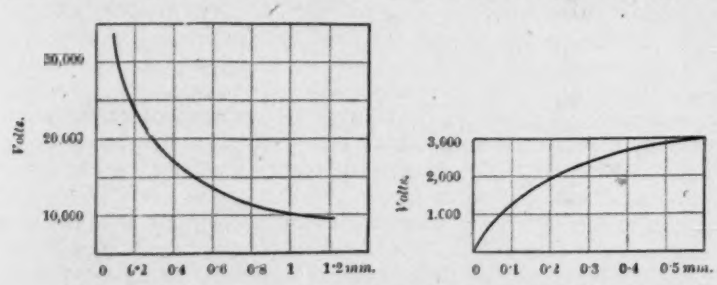
Hastings.—An illustrated article on the Hastings electric tramways, the greater part of which was recently opened. There are some extremely steep grades (1 in 9½) and sharp curves. The main portion is of the usual trolley construction, but it has not yet been decided what system shall be adopted along the sea front. The city objects to the trolley system at that place, and the conduit system appears unsuitable on account of the close proximity of the sea. It therefore would seem that a surface contact system is to be selected. The power house contains four 540-hp generating units.—Lond. *Elec.*, October 13.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Sub-Station.—An illustrated description of the Moscow-road sub-station of the Metropolitan Electric Supply Company in which 1,000-volt, two-phase currents are transformed for supplying the three-wire, single-phase supply network at 2x100 volts. Each transformer has a three-wire secondary winding. There are separate transformers on each phase.—Lond. *Elec.*, October 13.

WIRES, WIRING AND CONDUITS.

Dielectric Strength of High-Tension Insulating Materials.—KINZBRUNNER.—The conclusion of his paper on the ratio between thickness and dielectric strength of high-tension insulating materials. In the present installment he discusses varnished and impregnated papers. The term "impregnated paper" applies to a paper which, though soaked either while hot or cold in a thin insulating liquid, yet retains its paper-like surface, in opposition to "varnished paper," the surface of which is covered with a film of the actual insulating liquid. Tests with three kinds of varnished papers obtained from different manufacturers showed that their quality varied but little from each other. Fig. 6 shows the relative dielectric strength of varnished paper as a function of its thickness. The curve may be used for either one or several layers. Fig. 7 shows the dielectric strength as a function of the thickness for black impregnated paper; the dielectric strength increases as the square root of the thickness. On the other hand, the dielectric strength of several layers of this black impregnated paper is nearly proportional to the number of layers, exactly as was the case with untreated paper. The conclusion is that with varnished papers and linens —i. e., materials the surface of which is covered with a film of insulating varnish—the sub-division or the number of layers per given total thickness of insulation is immaterial from the electrical point of view, while with impregnated papers the dielectric strength per given thickness can be materially increased by using a large number of very thin layers. Some data are also given on rubber, gutta-percha and pure Para; the latter material seems to be the only exception from the general rules. These general rules are summed up as follows: "The dielectric strength of most of the insulating materials (Para excepted) is proportional to the square root of the thickness. This law may thus be expressed by the formula $E = C\sqrt{t}$, and for the sake of convenience C should be taken as the disruptive voltage of 1 mm. of the respective material, and should be termed its dielectric strength. The dielectric strength of a material (paper excepted), consisting of several layers of the same material, is directly proportional to the square root of the number of layers; this law may, therefore, be expressed by the formula $E = E_1\sqrt{l}$, where E_1 stands for the disruptive voltage of one layer, and l for the number of layers. Fig. 8 sums up the results as to this dielectric strength as a function of the thickness for various insulating materials on the basis of the author's determination.—Lond. *Elec.*, October 6.



FIGS. 6 AND 7.—CURVES OF DIELECTRIC STRENGTHS.

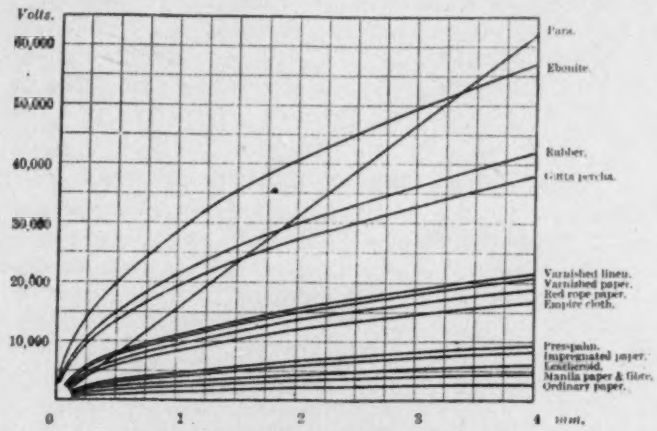
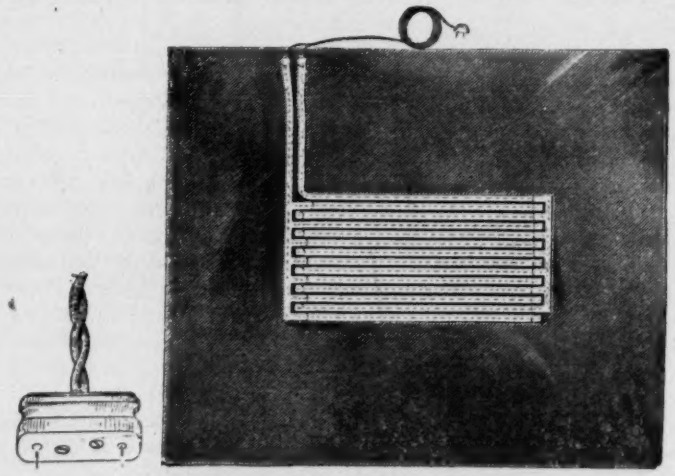


FIG. 8.—CURVES OF DIELECTRIC STRENGTHS.

Calculating the Cross-Section of a Line.—SARRATT.—A long mathematical paper in which the author first discusses the law of Lord Kelvin and then treats of the following mathematical problems: To find a conductor of minimum volume, first for a given total ohmic drop and second for a given energy loss. The results obtained are applied to three cases, in all of which the current increases along the line according to a linear rule; the first case is that of a cylindrical conductor; the second that of a conductor with a section proportional to the current (giving the best utilization of copper with respect to the energy loss); third, conductor of a section proportional to the square root of the current (corresponding to the best utilization of copper with respect to the total ohmic drop). He finally discusses the problem of finding the most economic conductor as a function of the distance, if the drop of voltage at the terminal of the line is given.—*L'Eclairage Elec.*, September 30 and October 7.

Electric Table Cloth.—An illustrated description of a table cloth by means of which it is possible to light standard lamps without putting wires on the table. This is effected by a cloth and plug constructed as shown in Figs. 9 and 10. A series of braided brass wires are sewn in the middle of the cloth, adjacent braids being of different polarities. Contact between them is prevented by ordinary sewing. In the base of the fitting is a plug carrying a couple of sharp brass points, which penetrate the cloth and make contact with the conductors inside the cloth. The contact points are fixed



FIGS. 9 AND 10.—ELECTRIC TABLECLOTH.

at such a distance apart that it is almost impossible for them not to enter conductors of different polarities. If, however, this should happen it is necessary merely to lift the fitting and put it down in a slightly different spot.—Lond. *Elec.*, October 13.

ELECTROCHEMISTRY AND BATTERIES.

Electrochemical Industries in Europe.—LEMEAU.—A long illustrated account of the electrochemical exhibits at the International exhibition in Liege with a review of the present condition of the industry in Europe, especially in France and Belgium. The electric furnaces for the production of ferro-alloys and high-grade steels by Keller, Heroult, Girod, Gin and Kjellin are described and illustrated. Other chapters deal with the electrolysis of water; the Solvay process for electrolysis of sodium chloride with a mercury cathode; the electrolytic production of chlorates and sodium peroxide, etc.—*Electrochem. and Met. Ind.*, November; from *Bull. Mensuel, Societe Belde d'Electriciens*, October.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Photometer.—An illustrated description of the portable "watt-photometer" exhibited the Olympia Exposition in London. In this instrument a carefully calibrated incandescent lamp forms the standard, and the candle-power of the lamp under test is read off on a direct reading scale, the accuracy being independent of fluctuations in the voltage. The lamps are completely enclosed, so that the apparatus can be used in broad daylight without any inaccuracy being introduced. A direct reading wattmeter is fitted into the same case, and is provided with an additional key, on depressing which the pointer indicates the specific consumption of the lamp directly in watts per candle-power. The internal connections are shown in Fig. 11 where *V C* is the volt coil, *C C* the current coil.

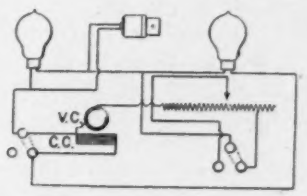


FIG. 11.—PHOTOMETER CIRCUITS.

It will be seen that as the right hand lamp holder travels towards the photometer, it passes over a number of contacts, whereby the resistance of the pressure circuit of the watt-meter is decreased and vice versa. The value of these resistances is such that the scale can be graduated directly in watts per candle-power. When it is desired to read watts only, this variable resistance is replaced by a fixed resistance. The candle-power, total consumption and the specific consumption of the lamp are thus read off directly, and without any calculation. Connection can immediately be made to any electric light fitting by means of an adaptor which is attached to the instrument.—Lond. *Elec.*, October 6.

Speed Indicator.—An illustrated description of the "Vulcan" speed indicator exhibited at the Olympia exposition in London. It consists of a dead-beat hot-wire voltmeter, supplied with current from a small magneto dynamo, which is driven by a rubber band. The voltage of the dynamo and, therefore, the readings of the indicator are directly proportional to the speed, while the dial is calibrated to show the speed in miles per hour. A flexible cord connects the dynamo to the indicator. The dynamo has only one moving part which is merely an armature of soft iron, and there are no moving wires, brushes or commutators.—Lond. *Elec.*, October 6.

Meter for Storage Batteries.—REYVAL.—An illustrated description of various types of meters exhibited at the Liege exposition. Among them are several types of the O'Keenan meter which consists principally of a small magneto-electric motor, the armature of which is shunted with a resistance through which the total current of the installation flows. One special kind of this meter is adapted to give the total of the ampere-hours of charge and discharge of storage batteries and to indicate at any moment the condition of charge of the battery. The shunt consists of a resistance divided into two adjustable parts by means of a sliding contact, the ratio of these two parts being equal to the efficiency of the battery (ratio of the ampere-hours of charge to those of discharge. The discharge current passes through the whole shunt, while the charging current passes through only one part. During charging the dial needle revolves in a sense reverse to that of the revolution of the hand of a watch and gives the quantity of electricity introduced into the battery directly in ampere-hours, but reduced in the proportion of the efficiency of the battery. During discharge, the needle goes in the opposite direction and indicates at any moment the condition of charge. Small auxiliary dials give the total discharges in ampere-hours.—*L'Eclairage Elec.*, September 30.

Recording Galvanometer Readings Photographically.—A note stating that Diesselhorst uses an incandescent lamp which is caused to flash-up at regular intervals by a pendulum device, the lamp filament being reflected by the mirror of the galvanometer on a fixed sensitized plate. Good records are obtained when the lamp is over-run, the author having obtained successful records with a 2.5-cp., 100-volt Siemens & Halske lamp, having a filament 6 cm. long and fed from a 110-volt supply circuit.—Lond. *Elec.*, October 6.

Electricity Meters.—GERHARDI.—The continuation of his illustrated serial in which he describes the arrangement of meter testing tables, meter stands and testing racks.—Lond. *Elec.*, October 13.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Distinctness of Telephone Sounds.—WIERSCH.—An account of an investigation of the conditions which determine distinctness in the reproduction of speech by the telephone, microphone or phonograph. The sources of indistinctness are the sibilant sounds represented by *s, z, sh* and *f*. These are, as a rule, very imperfectly rendered or actually inaudible. The author found by manometric flame observations that the frequencies of these hissing consonants lie two or three octaves above the proper tones of the usual diaphragms. Now a diaphragm is most easily set in motion by a vibration of its own period. Notes of low pitch usually have some overtone which affects the diaphragm, but the hissing sounds are themselves too high for that. Their pitch is at least as high as that of a closed pipe 14 mm. in length. To reproduce them faithfully, therefore, it is necessary to have membranes of high pitch, and these can be obtained by special tension devices and magnet construction. The various sibilants thus become clearly distinguishable. That the human ear can distinguish them the author explains by the fact that the external ear consists of a set of resonators responding to notes of very high pitch. Such notes are also produced by some insects, and by the bursting of froth bubbles.—Lond. *Elec.*, October 13; from *Ann. d. Physik.*, No. 10.

MISCELLANEOUS.

Electric Cooking.—An editorial with reference to the demonstrations of electric cooking apparatus at the present Olympia Exposition in London. Advantages of electric cooking are the absence of flame, smoke, fumes, and the immunity from fire risk; further with suitable arrangements the heat can be supplied at any spot needed so that one part of a dish can be kept cool, while the other is subjected to a high temperature, and the heat of every part of the cooking vessel can be regulated to a nicety. The cook can devote herself entirely to the cooking, there being no fire to claim her attention. The main disadvantage is the large waste of energy in burning the coal as a steam producer, generating electrical energy and transforming it back into heat. Concerning the energy required, figures are given for an electric grill for use in hotels or restaurants. "This measures 40 in. by 32 in.; it takes 82 amperes at 110 volts (i. e., about 9 kilowatt hours per hour), and only 10 min. are occupied in the preliminary heating up; it is said that 130 mutton chops may be cooked on it simultaneously in 15 min." Electric cooking appliances have two distinct forms. In one type a coil of wire or films of metal are imbedded in an insulating and refractory substance, in the second type long lamps are used. The latter have the advantage that the heating body is more readily replaced, and is less costly than in the embedded-conductor pattern, but naturally there is more heat lost from radiation and convection. "For some forms of cooking, luminous heat rays are preferred by cooks; in fact, for toasting and for the inefficient process of roasting on a turning spit they are essential. By employing a roasting oven with lamps all around it, moreover, similar results can be obtained as with a revolving spit, and continual basting is possible, while there is far less waste of heat than in roasting a joint before the open fire. Probably a perfectly electrically-equipped kitchen will contain both forms of heaters, and some of them will be combined in the same apparatus." All these appliances are at present very expensive. Several of these appliances are described and illustrated in the report of the Olympia exhibition in the same number.—Lond. *Elec.*, October 6.

BOOK REVIEWS.

ELECTRIC RAILWAYS THEORETICALLY AND PRACTICALLY TREATED. By Sydney W. Ashe and J. D. Keiley. New York: D. Van Nostrand Company. 285 pages, 172 illustrations. Price, $2.50 net.

This book deals exclusively with the rolling stock and its electric equipment, and as no mention is made of track constructions, power house installations or of the transmission or distributing circuits, the title is somewhat misleading. It treats of the trucks, the car bodies, the motors and the control apparatus, and describes briefly a few types of direct-current locomotives for industrial, mining, freight-haulage and passenger-haulage purposes. A useful feature of the book is to be found in Chapter II, which deals with the analysis of train performance. While it cannot be claimed that the information contained in the 34 pages of this chapter is in any respect new to electrical railway engineers, it is presented in a way which should find favor with such engineers on account of its combined completeness and availability for ready reference. Under the head of "Train Recording and Indicating Instruments" the Keiley recorder, the Sheldon accelerometer, the Armstrong recording ammeter and the Arnold dynamometer car are given deserved prominence. Both the theoretical and the operating features of direct-current motors are discussed, but no attempt is made to deal with the problem of designing such machines, although the requirements of motors for specified services are outlined in the section of the book dealing with train performance.

Under alternating-current railway motors only those of the single-phase commutator type are discussed. It is, perhaps, too much to expect that an adequate and accurate description of both single-phase series and repulsion motors could be given in the 16 pages allotted to these machines. While the descriptive matter is in the main accurate, there are several misleading errors, which a little well-directed care could have eliminated. There is evidently a confusion of apparent power with real power when the authors state on page 91 that "the output of an alternating-current motor is the product of the efficiency, the power factor and the input." There is likewise a confusion of the "transformer-series" motor, as designated by Lamme, with the "repulsion-series" motor, as developed by Winter-Eichberg. The illustration on page 93 shows the former machine, while the descriptive matter relates to the latter.

A considerable portion of the book is devoted to types of controllers and their operation. The types described include plain rheostatic, series-parallel, multiple-unit, and unit-switch systems for direct-current operation, and the potential-regulator system for alternating-current operation. The treatment throughout the book is largely descriptive in nature, very few mathematical equations being employed, and the use of calculus has been avoided except in one or two instances. The book should serve well as a reference for those interested in problems connected with the rolling stock of electric railways.

DIE FERNLEITUNG VON WECHSELSTROMEN. By Dr. G. Roessler. Berlin: Julius Springer. 243 pages, 60 ills. Price, 9 marks.

The author of this volume has virtually prepared in it a text-book on the theory of alternating-current transmission lines according to the fundamental physical conditions. Hyperbolic functions are not employed explicitly, although a large number of formulæ are of hyperbolic trignometry in disguise.

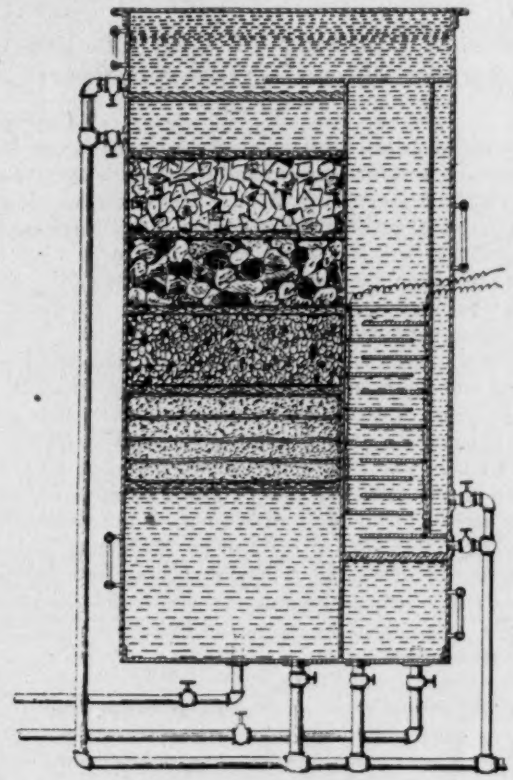
Although the treatment is mathematical throughout, yet a number of practical engineering data, concerning cables and transmission wires, are given in the tables. The illustrations are clear and give good graphical representations of the quantities discussed. The book contains more exact information concerning the theory of long-distance alternating-current circuits than any that has yet appeared to our knowledge in the German language.

From the engineer's standpoint the treatment is somewhat refined and laborious, because for nearly all practical purposes alternating-current transmission lines may be treated as having their total capacity located in the center of their length. It is only for relatively high frequencies, or unusually great lengths of line that a more rigid mathematical analysis is required. The book will be a useful text-book to students of the advanced theory of alternating-current circuits.

Purifying and Softening Water by Electrolysis.

The Electric Water Purifying & Filter Company, New York, is placing on the market apparatus for the purification and softening of water which is claimed to embody all the advantages of efficient filtration and cheap electrolysis. This system, it is claimed, will purify and soften water at a cost not exceeding 1½ cent per thousand gallons, computed for the most obstinate of waters and on the prevailing charges of the New York Edison Company for electricity.

The electrolytic action causes the precipitation of the principle scale-making compounds, found almost everywhere in water, consisting chiefly of sulphate of lime (gypsum), carbonate of lime, carbonate of magnesia, phosphate of lime, oxide of iron, and silica. The passing of the hard water through the apparatus causes the precipitation of most of the mineral substances above described, the acidity is destroyed and the iron deposited at the cathode. The principle advantage of the system, however, lies in the fact that it not only prepares good water for industrial purposes, but it prepares pure water for drinking purposes and can be adopted for use in apartment houses, hotels and even in connection with city water supply.



ELECTROLYTIC WATER PURIFIER.

The new process, instead of driving free oxygen from the water, liberates an excess of this element, which, owing to the shape of the positive electrode, is kept in contact with the water and eventually is re-dissolved. This has the effect of strongly vitalizing the water and at the same time sterilizing it, owing to the bubbling through it of nascent oxygen generated at the anodes, it being a well-known fact that nascent oxygen is one of the most active of germicides. Another important factor which tends to rid the water of bacteria is the precipitation of solid matter; this tends to carry down with it other substances held in solution and effectually clears the water of organic matter.

The following is an analysis made on crude polluted river water after electrical treatment and before filtration:

	Polluted Water.	After Treatment.	Amount Eliminated.
Dry residue and salts	0.3048	0.1826	0.1220
Organic matter	0.1068	0.0312	0.0756
Mineral matter, sand, etc.	0.1960	0.1516	0.0464
Chlorine	0.02485	0.01775	0.0071

BACTERIA PER CUBIC CENTIMETRE.

Before Treatment.	After Treatment.	Eliminated.	Per Cent. Eliminated.
340,000	75	339,925	99.975

It will be seen that the amount of bacteria remaining was only

twenty-five one-millionths of the quantity present before treatment and results have shown that most of these are removed by subsequent filtration. The only germ which is not affected by the treatment is the *bacillus subtilis*, which, as is well known, withstands even heat and antiseptics, but is perfectly harmless. One of the important features brought out by the analysis is that this process entirely eliminates nitrates and nitrites, which are always contained in water which has been contaminated by sewage.

The accompanying illustration shows the apparatus as adapted to hotels and apartment houses. It consists of a cylindrical iron tank divided into two parts by a vertical partition. The anodes are baffle-shaped plates of iron arranged as shown, the cathode being the wall of the tank itself. By this arrangement the hydrogen, liberated at the cathode, has free access for escape, while the oxygen, liberated at the anodes, is held in confinement until enough has accumulated to overflow into the surrounding water. The solid matter is precipitated to the bottom of the tank while the treated water overflows to the filter contained in the other half of the tank. The outfit is very simple and easily transported.

Successful Starting of Gas Engine-Driven Single-Phase Railway System.

Announcement is made of the successful starting of the Warren & Jamestown alternating-current railway system operating between Warren, Pa., and Jamestown, N. Y. The electrical equipment has had several weeks' preliminary run from a small gas engine driven unit temporarily installed in the power house at Stoneham. On October 19 the large gas engines were placed in service for the first time and a permanent operating schedule was inaugurated. Probably the most interesting feature of this rather unique railway system is the exclusive employment of horizontal double-acting gas engines of the heavy duty type for the generation of power to operate the road. Two of these engines are now installed, the first of which is already operating. The second will be placed in service in a short time. These two engines will be called upon to operate in parallel on the electrical end. Parallel operation is particularly difficult in service of this kind on account of the violent fluctuations in load which occur, due to the size of the cars employed and the small number in operation at any particular time. As it is not possible to utilize storage batteries to absorb these fluctuations, the engines are called upon to sustain them and are thus put to the severest possible test.

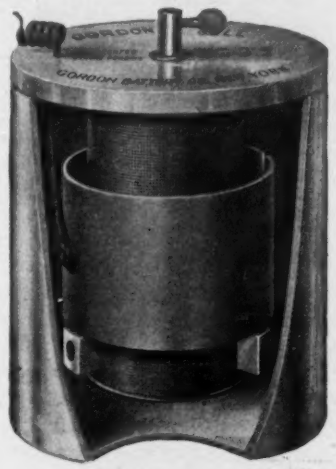
The two units installed are each of approximately 500 hp capacity, direct-connected to 260-kw revolving-field engine-type, single-phase generators. Each has two cylinders arranged in tandem fashion with a single crank. They will operate entirely upon natural gas distributed by a local company. In this district the gas has a calorific value of 1,000 B.T.U. per cubic foot. A 55-hp vertical Westinghouse engine of the single-acting type is also in operation driving an air compressor and exciting unit for the main equipment.

Current is generated directly at a voltage suitable for transmission without the use of transformers. Transformer sub-stations are located along the right of way which reduce the line voltage to 3,300 volts for the trolley at which pressure it is collected by the cars. The Warren & Jamestown Street Railway, although recently organized upon its present basis, has been running part of its present line for eleven years. Three years ago it began experimenting with gas power with sufficient success to induce the use of gas engines for the entire power generation.

Gordon Cells.

In the construction of the Gordon cell, which is shown in the accompanying illustration, attempt has been made to eliminate, as far as possible, the objectionable feature of the usual primary cells which resides in the time and labor necessary to set up and recharge them.

The copper oxide (negative element) is used in flake form, and is shipped in perforated metal cylinders, the perforations of which are closed in such a way as to prevent leakage in shipment. Attached to the cylinder are three porcelain insulating supports, upon which the zinc (positive element) rests. The zinc is made in circular form, and is held in place by the lugs; it does not hang from the cover of the cell. For the solution, high-grade caustic soda is used in powdered form. The jars are made of glass, porcelain and enameled steel, and are provided with tin, porcelain and fibre covers. The perforated cylinder, containing the copper element, and to which the zinc is attached, is fastened securely to the cover by a substantial binding-post.



PRIMARY CELL.

This cell is manufactured by the Gordon Battery Company, 439 East 144th Street, New York.

Gas Engines in the Rockland Central Station.

To the Rockland Electric Company of Hillburn, N. Y., belongs the credit of inaugurating an interurban electric supply system from by-product producer gas fuel in connection with power and fuel gas supply to adjacent industrial works. The use of gas power arose from the extremely low fuel cost of gas power and from the advantages of fuel gas in furnace work. The present power equipment, totaling about about 1,075 hp generating capacity, not including an exciter unit, consists of three 19x24-in. Westinghouse double-acting gas engines, direct-connected to 225-kw Westinghouse two-phase generators and a 75-kw Westinghouse vertical three-cylinder unit for operation during light loads upon the plant.

Having found its present equipment inadequate to meet the increasing demands for electricity, the Rockland Electric Company has placed an order with the Westinghouse Machine Company of East Pittsburg, Pa., for two additional 23x30-in. two-cylinder double-acting horizontal tandem gas engines. These engines will be of the four-cycle type, imparting two impulses to the crank shaft at each revolution irrespective of the load. Each will drive a 60-cycle alternating-current generator and will operate on producer gas of approximately 125 effective B. T. U. per cubic feet. The normal rating of each engine will be 470 hp, and each will be capable of developing 10 per cent overload for a period of two hours. After the installation of the two engines now on order, the total capacity of the equipment will approximate 2,100 hp.

The gas power plant of the Rockland Electric Company has been in continuous operation during regular working days for nearly a year, supplying power for lighting the surrounding towns, power for adjacent Ramapo Iron Works and fuel gas for a number of heating furnaces. The principal product of the gas plant—water gas—is exclusively used for this purpose on account of its high flame temperature, while power gas is a by-product. Both gases are generated by one system—the Loomis-Pettibone—three complete generating sets being in use. It is frequently the case that the cost of electric power in small suburban communities is prohibitive to a large number of residents, resulting from the high cost of generating steam power; but in this case, owing to the ability of the gas engine to thus turn to useful account a practically waste product, the cost of power is greatly reduced and the cost of an otherwise expensive gas is decreased sufficiently for general manufacturing purposes.

Vigorous Lighting Campaign.

The Edison Electric Company of Brooklyn has inaugurated a vigorous campaign for business by full-page advertising in all the local papers, offering to wire any house for $95, on easy payment terms, with 9 outlets, 12 lights, switches, etc. It will be interesting to see the result of these laudable efforts. Believing the matter to be one of interest and importance to many of our readers, whom it may help by way of suggestion, we reproduce in smaller fac simile the advertisement herewith. The same advertisement has been reprinted, full size, as a handsome circular, by the Edison Company, and in that form will reach a large number of the well-to-do householders of Brooklyn. Thus the appeal will be reinforced and the subject will be taken up and discussed in hundreds of homes where never before had the use of electric light and power come up as feasible, however desirable it might be. We understand that the Edison Company, pursuant to usual policy, will leave to contractors the wiring, etc., to be done, they having agreed to execute all such work satisfactorily at the price named. Thus a stimulus to local business is given all along the line, the contractors with their men benefiting also by this progressive action on the part of the company. Although the "ad" is hardly cold, a number of returns have begun to come in, and the winter's campaign for new business shows encouraging results even from the very start.

Is Your Home Wired for ELECTRIC LIGHT?

If not, the Edison Company will help you to have it Wired, so that you can enjoy the incomparable conveniences and advantages of ELECTRIC LIGHT in your home at comparatively little outlay.

How We Will Help You To Wire Your Home.

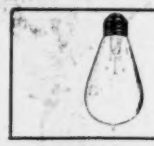
IT often happens that to Wire an entire residence from cellar to attic involves a considerable expense--more than the householder feels like paying, or is in a position at the moment to pay. If, however, the less important rooms are eliminated from consideration and the *living rooms*--those rooms in which an Electric service would be the biggest boon to you--dining room, kitchen, front and rear parlors, main halls, etc., are Wired, then the expense of Wiring is comparatively small, and well within the means of the average Brooklynite.

The Edison Company has, by competitive bids and after close figuring, made arrangements with certain wiring contractors, whereby for

Ninety-five Dollars

you can have your home Wired and equipped for Electric Lighting, as follows:

Dining Room	1 Outlet, 2 Lights.
Basement Hall	1 Outlet, 1 Light.
Cellar	1 Outlet, 1 Light, including 1 Switch.
Kitchen	1 Outlet, 1 Light.
Rear Parlor	1 Outlet, 3 Lights.
Main Hall	1 Outlet, 1 Light, 1 Flush Switch.
Parlor	3 Outlets, 3 Lights, including Base Receptacle.



This price covers everything you will be called upon to pay for this installation, including Electroliers and Glassware of suitable patterns. There are no extras. If you desire more Lights than provided for in this plan, you can secure them at approximately proportionate cost.

The cellar switch enables you to light the cellar from the kitchen floor and extinguish the light after you return therefrom. You thus always enter and leave a lighted cellar. Of course, you understand that with current from any of these outlets you can run an electric fan or heat an electric flatiron or water boiler, coffee pot, chafing dish or the like.

By this arrangement you can enjoy at once an Electric service with all that it means in the way of health, comfort, convenience, conservation of eyesight and the additional "tone" to your home; and if later on you desire to extend the service to other parts of the house, this may easily be done, as the installation is effected on the three-wire feeder system, so arranged as to permit of extensions with economy and expedition. Moreover, under improved modern methods of wiring, the work can be done with no injury to decorations and little inconvenience to the household.

Partial Payments if You Wish.

If it is inconvenient just at this time for you to expend the $95.00 in a lump sum, we will finance the deal, and you can pay us back in twelve monthly installments (covering a period of one year) without interest. As for the actual

Cost for Electric Lighting

you will find that, in spite of its immense superiority, under rates reduced by forty per cent. since January 1, 1905, Electric Light is now practically

As Cheap as Gas.

The above is the new Edison proposition for Wiring Brooklyn residences. The rest is "up to you." Do you want to be up-to-date? Do you care to have your home as convenient and comfortable for you and yours as you can make it? You would consider it poorly equipped without modern sanitary plumbing, with no better heating system than was used twenty years ago, with a well in the front yard instead of a connection with the city water.

None of these things is more essential or more truly effective for health and comfort than Electric Light, which requires no matches, has no open flame, does not consume oxygen or pollute the air, is a balm to tired eyes, and sheds a golden refulgence that is the acme of ideal illumination, at the same time adding a new element of beauty and elegance to the home.

If you would like to have this beneficent Lighting and Power service in your home, let us hear from you. A simple method of communication is to tear off the Coupon in the right hand lower corner of this page, fill in your name and address and mail to us. You will receive prompt response from an intelligent representative, who will be glad to furnish further details and talk the matter over with you. By acting promptly your home can be Electrically Lighted for the holidays.

Edison Electric Illuminating Co.
Of Brooklyn,
360 Pearl Street, Brooklyn.
Telephone Call, 4640 Main.

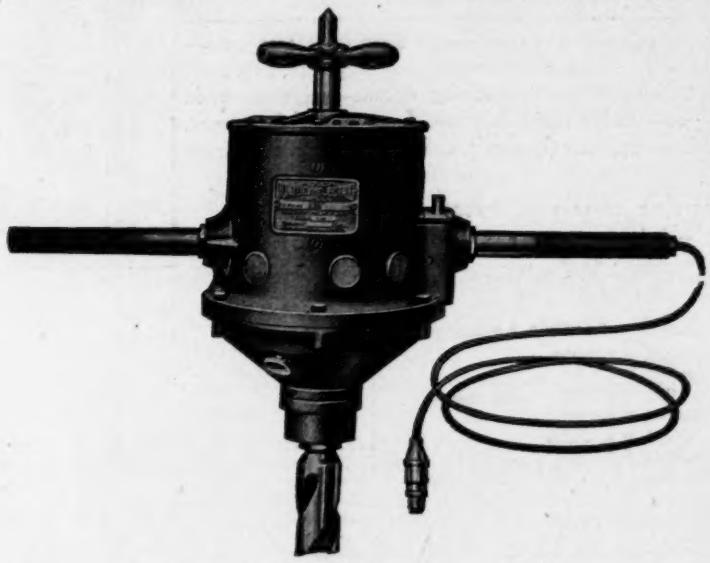
RETURN COUPON.
Edison Electric Illuminating Co. of Brooklyn,
360 Pearl Street, Brooklyn
Please have some representative call and see me with reference to the wiring of my residence for Electric Lighting.
Name .....
Address .....
Convenient time to call .....

ADVERTISEMENT FOR ELECTRIC LIGHT BUSINESS.

Electric Drills.

The accompanying illustration shows a type of the Duntley air-cooled electric drills, which have been designed for use in machine shops, plumbing establishments, hotels, office buildings, apartments, and all manufacturing establishments where drilling or boring is required. It is stated that these drills were tested under all working conditions, to which pneumatic drills are subjected, before being offered to the public, with the result that hundreds are now doing service with excellent results.

The larger capacity single motor drills are provided with a friction clutch (or collar). When the machines are shipped from the factories, the collars set to slip at any time they may be cutting at a speed requiring amperage in excess of their rating. The slipping of the collar permits the motors to run at full speed while the drill spindle stops, thus preventing the blowing out of the fuse plug (which has been provided as an additional safeguard against damage by overloading the motors or by allowing the drill to stick), or the heating of the motors. When the drill sticks, allowing the friction collar to slip, a slight turn of the pilot wheel (or feed screw), to release the pressure on the drill, will cause the friction collar again to take hold and start the drill spindle rotating.



ELECTRIC DRILL.

The switch is at the base of the handle where it is operated easily and quickly by a thumb pressure. The drill shown in the cut is of the two-motor style, having two small motors in one casing, with a special method of field winding which insures uniformity of speed of all motors. The weight of the equipment has been kept down to a value which is not objectionable by the use of gearings which allow the motors to operate at high speed.

The success of these small electric portable drills is attributed to the use of fans attached to the lower end of the armature shafts. The armatures revolve at 5,000 r.p.m., and a liberal volume of air is drawn in and circulated between the field and armature windings, thereby insuring the proper cooling. These electric drills are being placed on the market by the Chicago Pneumatic Tool Company, Fisher Building, Chicago, Ill.

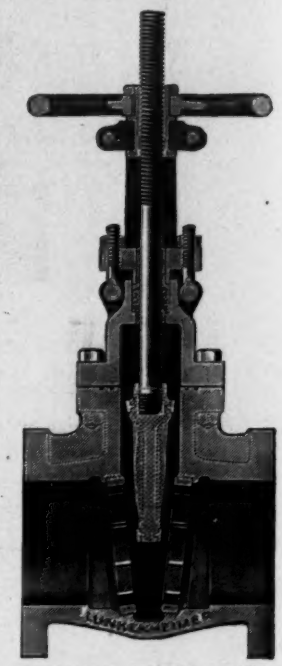
A Big Electric Lighting Display.

For a "one night stand" electrical display, the one recently made at Dayton, O., is worthy of note. It is no small job to put in the wiring and necessary apparatus to carry out an illumination which comprehends 400 acres in its scheme. This is what was done at Dayton. The result was a fairyland of electricity that attracted 35,000 people to the "world's greatest garden party." This party was given by the Men's Welfare League, an organization of factory employees. Five days before the day set for the party the electrical department of the National Cash Register Company set ten men to work to install the wiring in the trees and shrubbery on the country estate selected as the scene of the party. In putting in the apparatus there were used 59,347 feet of wire of various sizes, 33,898 candle-power in incandescent lamps, 3,300 weather-proof sockets, 1,850 receptacles, six gallons of lamp coloring and fifty pounds of tape.

A dancing platform, 70 by 80 ft., was lighted by 280 eight-candle-power and 140 four-candle-power incandescent lamps. The main entrance to the grounds was lighted with 350 four-candle-power lamps. Eight large electric signs advertised refreshment booths within the grounds.

An Improved Gate Valve.

In the "Victor" gate valve, a detailed view of which is shown herewith, the by-pass is not separate from the valve proper, but it is cast integral with the body, and it is claimed that this method has many points of excellence. The additional metal required for the by-pass tends to strengthen the valve body; being self-contained, it is not affected by extremes of expansion and contraction, which tend to distort the valves used on exterior by-passes. It will be seen that, instead of being screwed into the body, they are bolted thereto by several large steel studs and nuts, the latter seating on the spot-faced surfaces. The stuffing box is made of bronze, and has a flange on the bottom thereof, which prevents the iron flange above it from touching the iron body, and hence, prevents corrosion between these surfaces. These valves are manufactured by the Lunkenheimer Company, of Cincinnati, O. They are made of iron with bronze trimmings, in three different weights for working pressure up to 125, 150 and 250 pounds per square inch. They are also made entirely of bronze in two weights, suitable for pressures of 150 and 250 pounds per square inch.



SECTIONAL VIEW OF GATE VALVE.

"Noscru" Midget Push Button.

The miniature push button shown herewith is noteworthy on account of the easy method of connection, and of its substantial nature. It is practically indestructible, as it is made of porcelain and metal. It has all of the features and strength of an electric light appliance, although it is intended exclusively for bell work. This device is manufactured by the Sarco Company, 906 Sixth Avenue, New York, for the American Electrical Novelty and Manufacturing Company.

Electrically Controlled Oil Switches.

The tendency to design all central station apparatus so that it can be controlled from a central controlling board has led to a demand for a simple and inexpensive system of electrical control for high-tension oil switches.

In Figs. 1 and 2 are shown a front and rear view of a 15,000-volt electrically-controlled oil circuit-breaker made by the Hartman Circuit-Breaker Company, of Mansfield, Ohio. The panel containing the oil switch, operating solenoids and overload relays, can be installed at any convenient point in the station, and operated from the main switchboard by means of a small double-throw switch. The rotary movement used in opening and closing the Hartman switch readily lends itself to solenoid control. The usual operating handle is replaced by a steel sprocket wheel. The link belt which engages the sprocket wheel is attached at one end to the movable core of the closing solenoid and at the other end to the core of the opening solenoid. The downward movement of the core of the larger solenoid effects the closing of the switch, and the same movement of the core of the smaller solenoid effects the opening of the switch.

The operating current is derived from the exciters, a storage battery or any convenient source of direct-current supply. The solenoids can be wound for any standard voltage. When an automatic

switch is required, the overload relays are placed on the same panel and the operation of the plunger of either relay will close the direct-current circuit and effect the opening of the circuit-breaker.

A combined overload and inverse time-limit relay is shown in

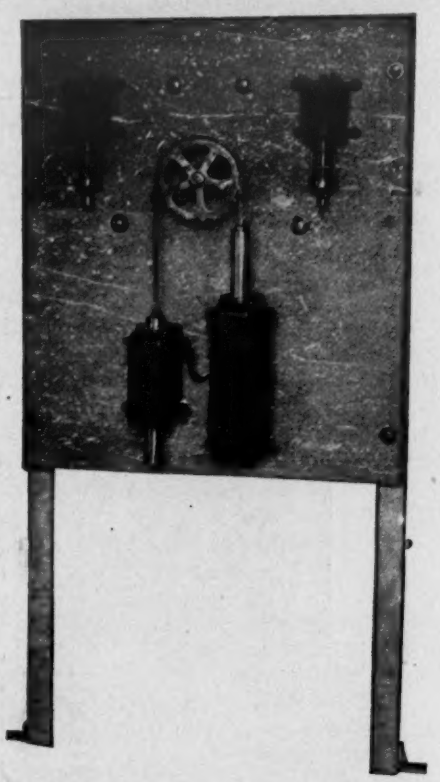


FIG. 1.—FRONT VIEW OF CIRCUIT-BREAKER, SHOWING CONTROLLING SOLENOIDS AND TIME-LIMIT OVERLOAD RELAY.

Fig. 1. The time-limit relay operates on the vacuum principle, the admission of a smaller or greater quantity of air into the brass tube containing the plunger having the effect of retarding or accelerating the movement of the latter. On an ordinary overload, the automatic opening of the circuit-breaker may be delayed for any

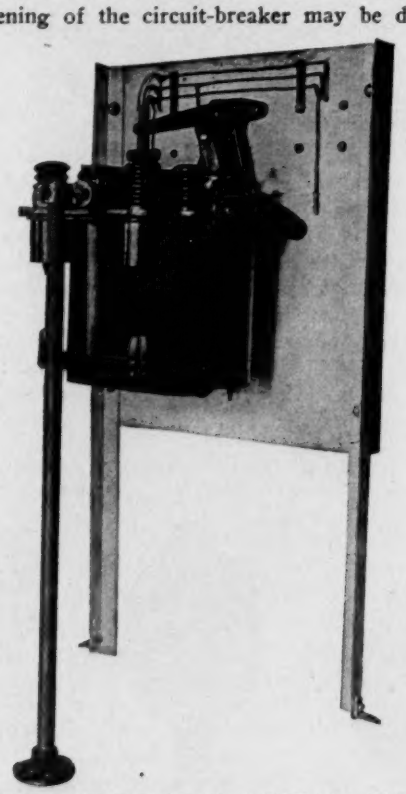


FIG. 2.—REAR VIEW OF CIRCUIT-BREAKER WITH ONE OF THE OIL TANKS REMOVED.

desired period up to 10 seconds. The heavier the overload, however, the quicker will be the action of the plunger, and an excessive overload or short-circuit will cause the plunger to act almost instantly.

The switch shown in Fig. 2 is a three-pole standard, type C switch, which is made for potentials up to 22,000 volts. The live parts of each pole are enclosed in a cell made of specially-treated indurated fibre. The contacts are of the laminated double-break type, and the oil tanks are moulded in such a way as to isolate each breaking point.

Small Power Motors.

In addition to the various mechanical tools which are now commonly driven by small power motors, either direct-connected, belted or geared, there remain such mechanisms as the sewing machine, the letter-sealing machine, the coffee mill, the massaging outfit and the various forms of copying machines, printing presses, etc., to which the electric motor may be applied to great advantage. The accompanying illustrations show a type of motor designed by the Fort Wayne Electric Works, Fort Wayne, Ind., to meet the demand for motors for these purposes. These machines are of both the direct-current and the alternating-current types. Motors of the former type are built for loads not exceeding one and one-half horse-power, while those of the latter type are constructed for

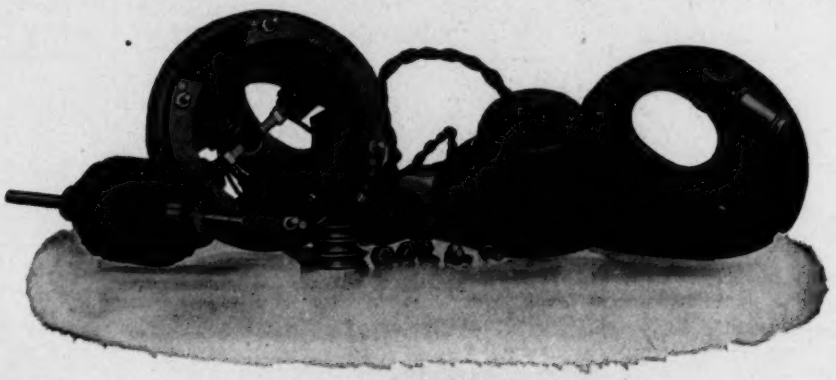


FIG. 1.—PARTS OF DIRECT-CURRENT MOTOR.

capacities not exceeding one-thirtieth horse-power. Fig. 1 indicates the constructional features of the direct-current motor, while Fig. 2 shows a machine of this type operating a vibrator outfit.

The frame of the motor is cast in two sections, hemispherical in form, which are supplied with two openings near either end of the shaft by means of which the commutator and brushes may be examined. Both the field and the armature cores are well laminated, the field laminations being stamped in such form as to provide a magnetic circuit entirely separate from the cast-iron frame.

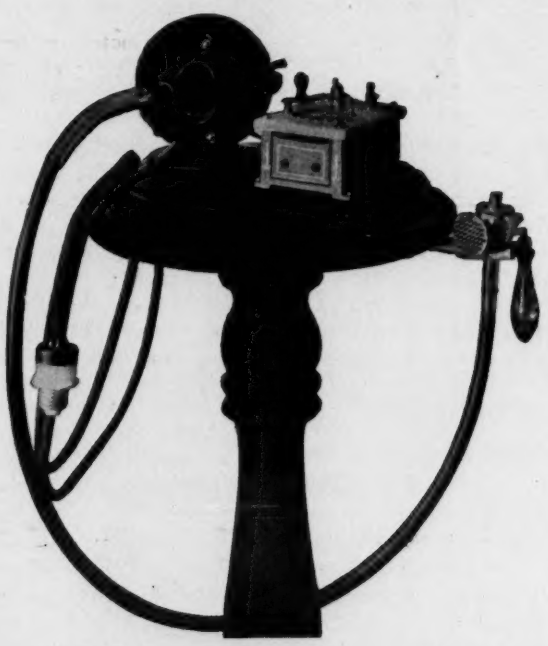


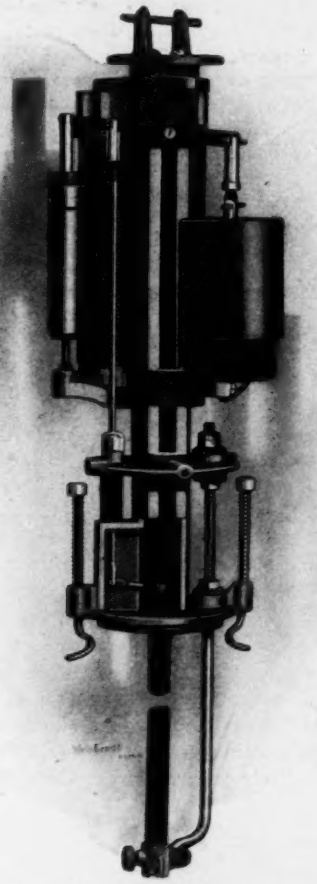
FIG. 2.—DIRECT-CURRENT MOTOR OPERATING VIBRATOR OUTFIT.

Nearly all applications of small power motors can be accommodated by the construction shown in the illustrations, but the Fort Wayne Electric Works announces that it is prepared to furnish special designs to meet any particular need which may exist for the use of friction discs or a system of gears.

Operating Mechanism of the "American" Arc Lamp.

In our issue for October 7 a brief description was given of the lamps manufactured by the American Arc Lamp Company, Kalamazoo, Mich. Below is given a description of the operating mechanism of the direct-current lamp. The accompanying illustration shows the frame complete, without covers, the upper part of the frame being cut away to give a view of the working of the clutch on the upper carbon. The frame is cast in one piece, with a hollow tube in the center for enclosing the upper carbon and the clutch.

The clutch is constructed on the toggle principle in order to insure reliability in feeding and to guard against the possibility of the carbon slipping. The resistance coil is wound on two solid



MECHANISM OF ARC LAMP.

ventilated porcelain cores. Particular care has been taken to insure that the magnet coil is indestructible. It is stated that the lamp may remain on dead short circuit for many hours without doing damage to the coil. The upper carbon holder is provided with a copper contact, and is entirely enclosed in the metal guide tube. The lower carbon holder is a single rod with a detachable holder, which when burned out may be replaced without disturbing the insulation of the rod. Realizing that the life of the lamp is largely dependent upon the dash-pots, the company has constructed the dash-pots of the "American" lamp of self-lubricating graphite, which gives the best of action.

Feed-Water Heater.

When water is being heated in a tube, the center will not heat so rapidly as the outer surface of the water. The feed-water heater shown in the accompanying illustration has been so constructed that when the water traveling through the tubes reaches the several ports at the top and bottom of the various sections of the tubes, the course of the water is entirely changed, thereby altering its relative position, thoroughly mixing it, and the temperature is thus equalized throughout the mass of the water. The heater is also so arranged that the water passes six times through the exhaust steam, thus obtaining the highest possible amount of heat units. The several parts which mix and thoroughly equalize the temperature of the feed water also accomplish another purpose—fittings are rendered entirely unnecessary and they have been dispensed with, so that friction caused by circulation is reduced to a minimum.

This heater, which is manufactured by the Loew Supply & Mfg.

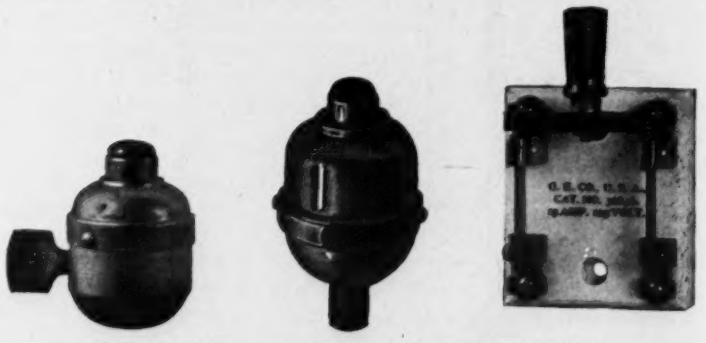
FEED-WATER HEATER.

Company, Cleveland, Ohio, is built of heavy cast-iron and brass. The outer shell, legs and caps are of cast-iron, and the tubes are of straight seamless brass.

Switches for Lamp Circuits.

In addition to its well-known pendant push-button type of switch the General Electric Company is now manufacturing the pendant key type (shown in Fig. 1). This form of switch is particularly designed for use where an inexpensive switch is desired to control one or two incandescent lamps, which are inaccessible and which do not require a 5-amp. or 10-amp. switch. It is neat in design and matches the company's standard sockets and receptacles.

The pendant push-button switch, illustrated in Fig. 2, is most useful in connection with temporary or permanent installations of incandescent or multiple arc lamps. It is also excellently adapt-



FIGS. 1, 2 AND 3.—PENDANT AND KNIFE SWITCHES.

ed for use with fan motors, as it locates the control of motors at the most advantageous points regardless of their accessibility.

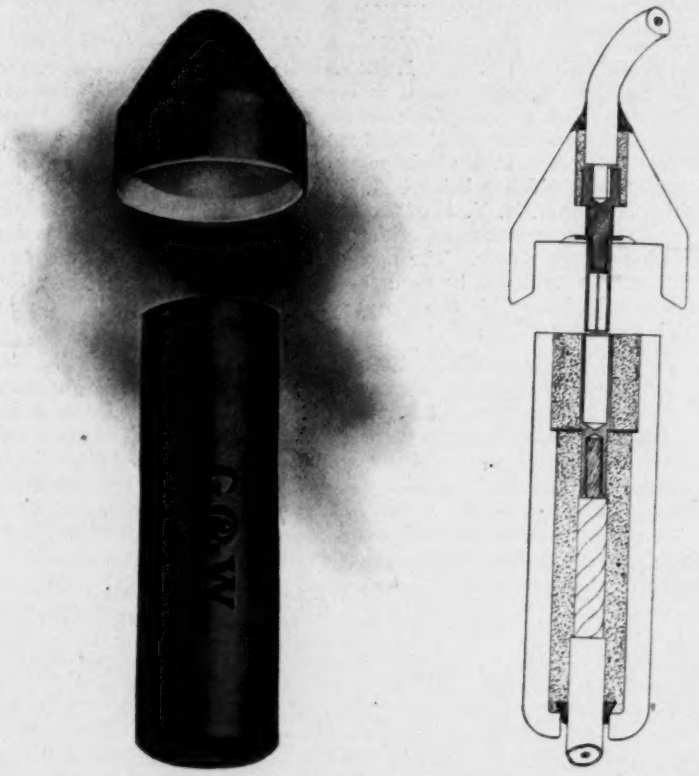
In both types of pendant switch the contact surfaces are of ample size and the mechanism is dependable. The circuit of the push button switch is closed by pressing a button at the bottom of the switch, and opened by pressing the release button at the side. The

key switch operates on the same principle as a standard key socket.

The double pole, 15-ampere, 125-volt, baby knife switch, indicated by Fig. 3, is a production of the General Electric Company. It follows the design of the large punched clip switches, and is neat, durable and compact.

A Detachable Pot Head for High-Tension Circuits.

Where high-tension overhead circuits pass to underground cables there has been felt the need of a pot head which will not only protect the end of the cable insulation, but which will also make it possible to disconnect the overhead from the underground lines. It is also sometimes desirable in ordinary overhead distribution to have disconnecting devices for branch lines on poles. The detachable porcelain pot head shown in Figs. 1 and 2 has been developed on the circuits of the Commonwealth Electric Company, Chicago, and is being offered on the market by the G. & W. Electric Specialty Company of that city. Fig. 1 shows the exterior appearance of the porcelain shell of this pot head, while Fig. 2 is a longitudinal section through the whole device. As seen in Fig. 2, the lead covered cable enters a long porcelain sleeve. This sleeve is clamped to the cross arm. The conductor of the cable is soldered

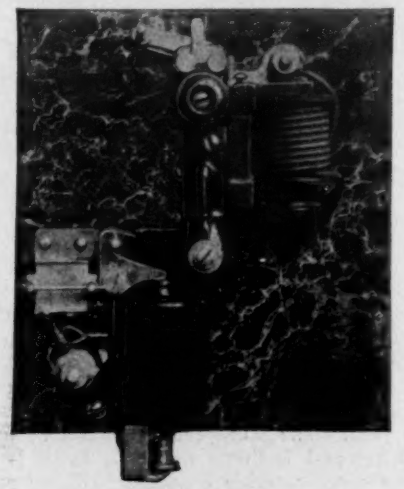


FIGS. 1 AND 2.—POT HEAD FOR HIGH-TENSION CIRCUITS.

into a brass sleeve, one end of which forms a receptacle for a split plug by which a connection is made with the overhead line. The brass sleeve is held in a central position in the porcelain sleeve by a washer. When a cable has been slipped into the sleeve the space between the cable and sleeve is filled with "Mineralac," or other insulating compound. The overhead line wire terminates in a plug in a porcelain cap, the space between the wire and cap being filled in with compound in a similar manner. The split plug in the cap slides into the receptacle which forms the cable terminal. Fig. 2 shows the plug withdrawn from the receptacle. It is evident that with such a pot head disconnection of overhead and underground lines can be accomplished instantly and without danger to the linemen. At the same time, the fact that porcelain instead of metal forms the outer covering gives a much higher degree of insulation than is possible with a lead sleeve. It is used on voltages of from 2,000 to 8,000. The device is one which appeals to every overhead construction man on account of its simple and substantial character and high insulation. It takes less skill to apply than a wiped lead pot head joint, and gives better and more impervious insulation than a taped joint, to say nothing of the easy disconnection feature other joints do not have.

Overload and No-Voltage Circuit-Breaker.

The following illustration shows an improved type of overload and no-voltage circuit-breaker being placed upon the market by the Ward Leonard Electric Company. The overload hood, latch and clip parts being on one casting, only five holes are required to be drilled for remounting. It is composed of two automatic circuit-breakers, one for no-voltage release and the other for overload release. The two are so related that the overload mechanism cannot be closed when



CIRCUIT-BREAKER.

the circuit is opened by the no-voltage circuit-breaker, and the latter cannot be closed or held closed when an excessive current flows, thus insuring safety of the motor and of the entire circuit in case of short-circuit and excessive current. The no-voltage switch is responsive solely to the line voltage and will open instantly when for any reason the counter e.m.f. of the motor falls below a protective amount.

Steady Demand for Steam Engines.

Although the steam engine of to-day must compete with the simplicity, compactness and effectiveness of the steam turbine and the high commercial economy of the gas engine, there are still many cases where it is found advantageous to install this class of prime movers. The advent of the steam turbine and gas engine only seems to stimulate the demand for prime movers of all types, and the steam engine business keeps pace with this demand.

The Westinghouse Machine Company, of East Pittsburg, Pa., which has built some of the largest steam engines in this country, has within the last few weeks booked orders for more than 75 steam engines, aggregating 10,764 horse-power. Of the different types of steam engines manufactured by this company 5,040 horse-power of marine type were sold, 2,740 horse-power of compound steam engines, 1,823 of "Standard," 801 of "Junior," and the remainder of Corliss. The largest single order during this time was received from the Tahuantepec Railway, of Mexico, for four 16-in. x 34-in. x 16-in. marine type engines and two 8½-in. x 8-in. Standard engines for equipping the Salina Cruz and Coatzacoalcos power houses.

Other orders were received from the Rio de Janeiro Tramway, Light & Power Company, of Brazil; the Chicago, Milwaukee & St. Paul Railway Company, Chicago, Ill., for compound steam engines, and still others from the Lawrence Machine Company, Lawrence, Mass.; Pennsylvania Railroad Company, Wilmore, Pa.; Hokkaido Tanko Railway Company, Japan; Muncie & Portland Traction Company, Portland, Ind.; International Steam Pump Company, New York; Kure Arsenal, Japan; Graham Brothers, Stockholm, Sweden; Vesta Coal Company, Pittsburg, Pa.; Gray Manufacturing Company, Gastonia, N. C.; Furukswa Western Bureau, Japan; Home Light, Heat & Power Company, Springfield, O.; Erie Railroad Company; Great Falls & Old Dominion Railway, Baltimore, Md.; the Sidney Electric Company, Sidney, O.; Kiuskiu Railway, Japan; Imperial Printing Office, Japan; Waltham Gas Light Company, Waltham, Mass.; Lumberton Cotton Mills, Lumberton, N. C.; American Car Heating Company; Santa Cecelia Sugar Company, Cuba.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Favorable progress in trade is the burden of reports from all sections. The lower temperature has stimulated business in seasonable merchandise, such as wearing apparel, etc., and removed the anxiety regarding the possible necessity of having to carry over heavy stocks at the end of the season. Inquiries for spring shipments from jobbers are undiminished, and little idle machinery is found in the leading manufacturing industries. Production and consumption are at a new high level, without the unsettling influence of a return to the inflated prices of a few years ago. Very liberal orders have been placed for cars and other rolling stock, which have been covered by sales of bars, billets and crude pig iron, the latter being most active at the East. Coal is active, but the Illinois and Indiana output is limited by the car supply. The same causes tend to stiffen the price of bituminous coal at the East. Lumber is active notwithstanding the lateness in the season. Textile mills are well employed, although the labor situation is not quite so favorable as it has been recently. New business is rather slow in coming in, however. Taken as a whole, the business situation is one which finds no precedents for this season of the year. The European demand for our breadstuffs is now materializing and business in this line, it is stated, is now limited only by cargo-carrying capacity. Higher prices for nearly all farm products have helped demand in agricultural districts, and, to a certain extent, improved collections. In the metal trade the market had a steady to firm tone. Lake and electrolytic copper closed at 16½c. and casting rock at 16¼c. The business failures for the week ending Oct. 26, as reported by *Bradstreet's* numbered 178, which is the same as those of the preceding week. In the corresponding week last year the number was 180.

EXPORT OF ENGINES.—At no time, perhaps, in the history of the United States has its export trade been so great as it is at present, this being especially true in regard to high-grade power machinery. The recent impetus given to the development of the Far East is responsible for a considerable part of this increase. During the past two months the Westinghouse Machine Company, of East Pittsburg, Pa., has booked many orders from foreign countries. Some of the important steam engine orders follow: One 16-in. and 34-in. x 16-in. marine type vertical cross compound engine for the Kure Arsenal, Japan; four 16-in. and 34-in. x 16-in. marine type and two 8½-in. x 8-in. standard steam engines for the Tehuantepec Railway of Mexico; one 11-in. and 19-in. x 11-in. compound steam engine for the Furukawa Western Bureau, Japan; one 13½-in. x 12-in. standard steam engine for the Hokkaido Tanko Railway Company of Japan; two 10-in. and 18-in. x 10-in. compound steam engines for the Kuiskiu Railway of Japan; one 14-in. and 24-in. x 14-in. compound steam engine for the Imperial Printing Office of Japan; one 9-in. and 15-in. x 9-in. compound steam engine for Graham Brothers, Stockholm, Sweden; one 18-in. x 16-in. compound steam engine for the Rio de Janeiro Tramway Light & Power Company of Brazil, and one 18-in. x 16-in. standard steam engine for the Santa Cecelia Sugar Company of Cuba.

WESTINGHOUSE-PARSONS TURBINES IN DETROIT.—The Public Lighting Commission of Detroit, Mich., has just placed an order with the Westinghouse Machine Company, of East Pittsburg, Pa., for a 2,000-kw turbine type generating unit, following this order shortly afterward with a second order for a machine of the same size. In the equipment of its power house on the river front in the center of the business district of Detroit, the commission has heretofore used vertical engines of the compound marine type. The early generator equipment was of the direct-current series type, the generators being rope driven from the vertical engines. Later the system was gradually replaced by the more modern alternating-current series arc system, with alternating-current generators of the direct-connected type. The two new units will be installed in the original building, replacing some of the rope-driven machinery. The turbines will be of the standard Westinghouse-Parsons type, operating at a boiler pressure of 160 pounds without superheat and at a normal vacuum of 28 inches. The generators will also be of standard Westinghouse design, of the revolving field type, and with the enclosed generator frame construction.

BIG STATEN ISLAND PLANT.—The Procter & Gamble Company, for the financing of its new soap plant on Staten Island, will increase its common stock 50 per cent, or from $6,000,000 to $9,000,000. The additional stock will be offered at par to holders of common stock. At present the stock is quoted at $450 a share in Cincinnati. The Procter & Gamble Company manufactures soap, candles and glycerine. With its original plant in Cincinnati, it built another in Kansas City a year or so ago. When the Staten Island plant is complete thousands of dollars now paid out in freight charges will be saved to the company. Actual work on the new plant will be completed in little over a year. William A. Procter is president of the company and James N. Gamble is vice-president. The new plant will need an extensive light and power equipment, and motors will be used throughout.

BELL TELEPHONES.—According to the report of the American Telephone & Telegraph Company, it had outstanding on Sept. 30, 5,324,217 instruments, a gain of 1,043,016 instruments over the number outstanding at the same date last year. This would give about 2,500,000 subscribers. The detailed figures are:

	1905.	1904.	Increase.
Gross output	160,613	106,305	54,308
Returned	51,494	38,353	13,141
Net	109,119	67,952	41,167
From January 1st to September 30th:			
Gross output	1,301,058	876,609	424,449
Returned	457,405	374,925	82,480
Net	943,653	501,684	441,969
Total outstanding	5,324,217	4,281,201	1,043,016

GRAPHOPHONE FACTORY.—The American Graphophone Company, Bridgeport, Conn., is erecting three additional buildings. The extension to the power house will be equipped with a new Allis-Chalmers compound condensing engine of 600 horsepower, direct connected to Bullock generators. The producer gas plant, 30 x 70 feet, which is being installed by the Wiley Power Gas Company, Rochester, N. Y., is of 600 hp capacity and will make producer gas direct from anthracite coal. The company will use the gas for heating purposes only. The new roll building is 65 x 110 feet, two stories high, and will be used for rolling the stock from which the flat graphophone disk records are made. In this building six new 24 horsepower rolls, motor-driven, will be installed.

MECHANICAL STOKERS IN RAILROAD SHOPS.—The Pennsylvania Railroad Company has very recently placed an order with the Westinghouse Machine Company for six 132 in. x 26 in. grate and four 100 in. x 20 in. grate Roney mechanical stokers to extend already its large equipment at Altoona. Two new boiler plants were erected at Altoona only a few years ago for supplying steam power at the Altoona shops. These plants were both equipped throughout with Roney stokers, and are representative of the high development of modern boiler plant construction.

WASHINGTON STATE POWER.—Stone & Webster, of Boston, have bought the Nooksack power plant from the Bellingham Bay Improvement Company, of Bellingham, Wash., and the lighting franchises of the company. Plans for the plant provide for an ultimate development of a total from 12,000 to 15,000 hp at a cost of approximately $1,000,000. This power will be used by the Whatcom County Railway & Light Company in connection with its railway and lighting interests in the city of Bellingham, and will also be sold for general power purposes.

AMERICAN TROLLEYS IN CANADA.—U. S. Consul Ifft, of Chatham, Ontario, reports that the Windsor & Essex Electric Railway Company proposes to construct an electric railroad from Chatham to Windsor, just across the St. Clair River from Detroit, connecting there with the American electric lines and at Chatham with the Chatham, Wallaceburg & Lake Erie road. It is expected that next spring will see the construction work on this line under way. Both these lines are backed by American capital.

TAXING TURBINE MODELS.—The action of the customs officials in exacting a heavy duty on miniature patterns of turbines for steamships has resulted in the Allis-Chalmers Company filing an appeal with the Board of United States General Appraisers. It is understood that the company imported the turbine patterns to use as models. Collector Stranahan held that the articles came within the meaning of the tariff provision for "manufactures of metal," and demanded duty at the rate of 45 per cent.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, Chicago, it is reported, is equipping the 4,500-line central energy multiple lamp signal switchboard now being installed by it at Meridian, Miss., with its new and improved combination listening and four-party indicating ringing keys. This key, it is said, has a number of new features in its construction that are of vital importance to the serviceability and durability of equipment of this kind.

FIGURES OF FOREIGN TRADE.—The foreign commerce transacted by and for the manufacturers of the United States will amount to more than a billion dollars in the calendar year 1905. In the nine months ending with September, for which the Department of Commerce and Labor, through its Bureau of Statistics, has just announced its figures of our foreign commerce, the imports of materials for use in manufacturing amounted to $442,000,000 and the exports of manufactures amounted to $424,000,000, a total of $846,000,000 in nine months, or an average of $94,000,000 per month, or more than $3,000,000 per day for the manufacturing interests alone. Manufacturers' materials now form practically one-half of the total imports of the United States, or, to be more exact, 48.4 per cent; and manufactured articles form practically 40 per cent of the total domestic exports, or, to be more accurate, 39.26 per cent. In 1890 manufacturers' materials formed 33 per cent of the total imports and manufactures formed but 20 per cent of the total domestic exports. Manufacturers' materials imported in the nine months ending September, 1905, were practically twice as great in value as in the corresponding months of 1890; while manufactures exported in the nine months ending with September, 1905, were practically four times as great as in the corresponding months of 1890, the figures for the nine months' periods of the years named being, for manufacturers' materials imported in 1890, $208,000,000, and in 1905, $422,000,000; and of manufactures exported in 1890, $113,000,000, and in 1905, $424,000,000. Thus the exportation of manufactured articles has grown much more rapidly than the importation of manufacturers' materials, suggesting that the exporters of the country are drawing, year by year, a relatively larger proportion of their raw materials from our own country. The fact, however, that manufacturers' materials now form a larger proportion of the total imports than in earlier years suggests that the growing requirements of the people of the United States in other lines are now being more fully met through home industries than ever before, while an analysis of the imports now brought into the country shows that a growing share of these increasing imports is of articles requiring for their production climatic conditions not existing in the United States.

A WEEK'S BUSINESS IN STEAM TURBINES.—During the week ending September 29, the Westinghouse companies of East Pittsburg, Pa., received orders from the Toledo Gas Electric & Heating Co., Toledo, O., for two 1,000-kw, turbo-generator sets, the Pennsylvania Railroad Co. for four 500-kw, turbo-generator sets, the Water, Light & Gas Company of Hutchinson, Kan., for two 500-kw, turbo-generator sets, and the Solvay Process Co., of Syracuse, N. Y., for one 500-kw, turbo-generator set. Each turbine will be of the type known as the multiple expansion parallel flow with an overload capacity when running condensing of at least 50 per cent, and the alternating-current generators will be of the turbo type with rotating fields. The turbines for the Toledo Gas, Electric & Heating Co. will be adapted for driving a direct-connected 60-cycle generator at 1,800 r.p.m., each being capable of developing 1,500 B.H.P. when operating at 1,800 r.p.m. with dry saturated steam at the throttle of 150 lb. pressure and 28-in. vacuum in the exhaust pipe. They will be provided with secondary governor valves by means of which 50 per cent overload may be developed, or full load developed when operating with condenser. The generators will have four poles and will deliver three-phase current at 4,400—4,800 volts. The generator frames will be of the enclosed type with the latest and most improved system of ventilation. The two 500-kw turbines for the Water, Light & Gas Co. will operate with dry saturated steam at the throttle of 150 lb. pressure and 28-in. vacuum. The 60-cycle generators will deliver two-phase current at 2,200 volts. The 500-kw steam turbine for the Solvay Process Co. will operate with dry saturated steam at the throttle of 125 lb. gauge pressure and 28-in. vacuum. The 60-cycle direct-connected turbo-generator will deliver two-phase current at 440 volts. This company already has in operation a number of Westinghouse steam and gas engines, in addition to 3,500 horse-power in Roney mechanical stokers. Westinghouse apparatus is also installed in the Detroit plant of this company.

AMERICAN DE FOREST WIRELESS TELEGRAPH COMPANY.—The following list of stations with the kilowatt capacity of each covers the De Forest installation at present in operation in the United States, Canada, Central America, Cuba and Brazil, the figure in the brackets denoting the capacity: Portland (2), Mobile (2), Boston (20), Providence (2), New Orleans (35), Springfield (5), Southwest Pass (2), Hartford (2), Galveston (2), New Haven (2), Port Bolivar (½), Bridgeport (2), San Francisco (2), New York (2), Cheyenne (2), Manhattan Beach (40), Boulder (2), Paterson (1), Denver (2), Galilee (2), Colorado Springs (2), Philadelphia (2), Cripple Creek (5), Atlantic City (2), Pueblo (5), Washington (8), Trinidad (5), Cape Hatteras (5), Kansas City (15), Charleston (2), Kansas City (20), Savannah (2), St. Louis (20), Jacksonville (2), Chicago (2), Key West (2), Chicago (20), Key West (Navy) (35), Indiana Harbor (2), Pensacola (10), Port Huron (1), Cleveland (5), Buffalo (5), Havana (2), Bocas del Tora (2), Ottawa (15), Port Limon (2), Quebec (15), Rio de Janeiro (2), Montreal (15), Santos (2), Porto Rico (35), Nome (2), Guantanamo (35), St. Michaels (2), Colon (35), and Ships 1 ea. (25). The combined capacity amounts to a total of 497.5 kilowatts of power which is being used by the De Forest installation in this hemisphere. The list of stations to be erected in 1906 shows a total capacity of 322 kilowatts, as follows: Toronto (25), St. John's, Nfd. (50), Dom. Govt. (32), Ships (25), Atlanta (40), Denver (40), San Francisco (80), Sault Ste. Marie (15) and Port Arthur (15). There will doubtless be many other installations, and it is stated that by the end of 1906 there will be more than 1,000 kilowatts available at the various De Forest stations.

THE PELTON WATER WHEEL COMPANY, of San Francisco and New York, has closed an important contract with the Oro Water, Light & Power Company, or Oroville, Cal. This covers two complete Pelton units of 2,000-h.p. capacity each, direct connected to electric generators, the wheels operating under 465 ft. head. The water wheel arrangement embraces the "double overhung" type of construction, which is typical of Pelton apparatus, especially in connection with engine type generators, forming a compact and self-contained unit. Sturgess governors will be employed, the requirements in this regard being exceedingly severe, as the current is to be used for both light and power. The latter involves the operation of gold dredges, in which the fluctuations of power and load are very sudden and heavy. Other recent orders are: A wheel equipment for the Crown Columbia, Paper & Pulp Company, of Washington, consisting of a triple Pelton unit for direct connection to heavy pulp grinders in the paper mills. The wheels are mounted upon a steel shaft 18 ft. in length, provided with an oil thrust bearing of special design. Takata & Company have ordered a 300-hp unit for Tokio, and a large wheel has just been furnished the Ingersoll-Sergeant Drill Company for direct connection to one of its compressers. Owing to the steady growth of its business, the Pelton Water Wheel Company is obliged to enlarge its works, and to that end has purchased a block of land in South San Francisco, where a modern machine shop is now under course of construction. This new shop will be equipped with the latest high-grade tools and handling devices, and it is expected to be a model of its kind, affording exceptional facilities for the construction of high-grade apparatus.

GOOD BUSINESS IN SIGNS.—The Haller Machine Company, electric sign works, Chicago, reports the following recent sales of large electric signs: Jas. S. Kirk & Co., Chicago, roof sign, 5 and 6-ft. letters; Val Blatz Brewing Co., Milwaukee, 6 and 24-ft. letters and stars; Anheuser-Busch Brewing Co. (for Baltimore, through McCay Engineering Company), 10-ft. trade mark and 4-ft. letter display sign; Klingman Furniture Company, Grand Rapids, Mich., through M. B. Wheeler Electric Co., large roof display sign; Topeka Edison Company, Topeka, Kan., one hundred and ten letter exchangeable roof sign; The Fair, Chicago, 37 5-ft. letters, changeable advertising sign; National Tube Company, Pittsburg, through Pittsburg Display Advertising Company, 30 5-ft. letters for mounting on tube frame, and others. Additional factory space has been secured, so that orders can be filled more promptly.

LEXINGTON APARTMENT HOTEL.—Percival Robert Moses, electrical engineer, 320 Fifth Avenue, New York, will act as consulting expert on the installation of a complete electric and refrigerating equipment for three ten-story buildings, 145-155 West Forty-seventh Street, Longacre Realty Company, owner, consisting of, in addition to present steam equipment, one 125-hp sectional boiler, one 12 x 12, one 11 x 12, and one 11 x 10 simple automatic high-speed engines direct connected to 50-kw, 40-kw and 30-kw direct-current compound wound multipolar 240-volt generators with motor-dynamos to balance the three-wire system. There will also be a complete 5-ton refrigerating machine installed for the ice supply of the dining room and café and refrigerating system for the kitchen and pantry boxes.

THE NEW PROCESS RAW HIDE COMPANY, Syracuse, N. Y., has announced its intention of going more extensively into the manufacture of metal gears of all kinds as well as its well-known New Process noiseless pinions. In furtherance of this plan the company has just completed a two-story brick addition containing about 10,000 feet floor space and is installing a number of additional turret lathes, drills, grinders, spur gear cutters, bevel gear planers and other machines necessary for the manufacture of accurate gearing. This additional equipment will increase the company's capacity about 75 per cent. Business with this concern is very brisk, and it reports shipments as considerably in excess of last year with prospects very bright for a continuance of same.

BUYING WIRES ON BRIDGE.—The Bridge Commissioner of Greater New York has been authorized to buy the wiring of the New York Edison Company on Williamsburg Bridge, so that it can be utilized by the city plant now started; instead of putting up new wires at greater expense.

INDEPENDENT TELEPHONE FACTORY.—Advices from St. Louis state that preparations of a definite character were made Oct. 27 at a banquet in St. Louis for inaugurating the operative plans of the United States Independent Telephone Company, the national corporation with a capital stock of $50,000,000 which was recently organized to conduct a general telephone business throughout the United States. The arrangements as now decided upon, contemplate the immediate building of a $6,000,000 telephone equipment plant in St. Louis and the enlargement of the present apparatus manufacturing establishment in Rochester, N. Y. The Rochester and St. Louis manufacturing plants will make the equipment. The Rochester factory will supply New York and the East and the St. Louis factory will supply the cities and states of the West. The Rochester company is capitalized at $6,000,000 and employes 2,500 men. Its investment will be increased, its buildings enlarged, its capacity doubled and its force of workmen raised to at least 5,000. The St. Louis concern will be of the same size as the present Rochester plant, having a capital of at least $6,000,000 and a force of at least 2,500 workmen. Breckenridge Jones, vice-president of the Mississippi Valley Trust Company, who is one of the most active promoters of the national independent enterprises, tendered the banquet Oct. 27, to the visiting capitalists and telephone officials at the St. Louis Club. More than fifty guests were assembled, including presidents and vice-presidents of the leading St. Louis banks and trust companies. General Counsel Page explained the franchise of the Mercantile Electric Company, which enables the company to operate in New York. He said that capital has been obtained for installing the metropolitan system, but declined to state what financiers of New York are interested.

ORDERS FROM JAPAN.—The Japanese engineering and contracting firm of Takata & Co., Tokio, Japan, 10 Wall Street, New York City, reports a large quantity of orders for Westinghouse apparatus. Among these may be noted the following: Furukawa Western Bureau: One 62½-kw, 570 volt, compound wound, direct current, engine type generator, direct connected to a Westinghouse 11 x 19 x 11 automatic compound engine. Senju Seijusho: Two type 7-B, D. C. generator panels; one type 7-B, D. C. feeder panel; one type 7-B, blank panel, all arranged to make a complete switchboard to control two 33-kw, 110 volt, shunt wound, D. C. generators connected for 3-wire distribution. Kosaka Mine: One 15-hp, 7,200 alts., 3-phase, 220 volt, type "C" induction motor; one 3-hp 7,200 alts., 3-phase, 220 volt, type "C" induction motor, which are to be direct connected to Denver Engineering Works electric mine hoists. Naval Briquette Works: One 10-hp, 110 volt, shunt wound, open type "S" motor, with back gear, ratio of 5 to 1; one 5-hp, 110 volt, shunt wound, open type "S" motor, with back gear, ratio of 5 to 1. Kimura Gold Mine: One type 13, 3-phase generator panel for one 3-phase generator, and one 3-phase feeder, 3,500 volts, 40 amperes; two 30-hp, 200 volt, 3-phase, 7,200 alts., type "C" induction motors; three 37½ kw, 7,200 alts., O. D. transformers; three 7½ kw, 7,200 alts., O. D. transformers.

BIDS FOR NAVY EQUIPMENT.—Bids will be received until Nov. 14 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of insulated iron wire, generating sets, electric cable, sockets, insulators, copper wire, etc. Address H. T. B. Harris, Paymaster-General, U. S. N. Bids will be received until November 18 by Mordecai T. Endicott, chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing underground, lead-encased, braid-covered, arc and incandescent lighting cables, as per specification No. 1450 at the United States Navy Yard, League Island, Pa. The estimated cost is $12,500.

THE SCHMIDT-WILCKES ELECTRIC COMPANY has completed its organization as an independent telephone and switchboard manufacturing concern, with a plant located at Weehawken, N. J., and offices at 135 William Street, New York City. President Lambert Schmidt states that it has secured some very valuable telephone patents and under them will make its new product. The officers are, besides Mr. Schmidt, who is well-known as a telephone inventor and manufacturer, Mr. Felix Wilckes, vice-president; Mr. Ferdinand Wilckes, secretary and treasurer; Prof. R. A. Fessenden and Mr. E. Van Berlo.

TELLURIDE POWER ENTERPRISE.—Manager L. L. Nunn, of the Telluride Power Company, has recently filed an application with the state engineer for 60 second-feet of water from the Duchesne River, in Wasatch County, for power purposes. He proposes to erect a power plant to furnish light and power for Park City, Salt Lake, Bingham, Mercur, Eureka, Price, and other localities. The water will be diverted through a 60,700-ft. canal.

Financial Intelligence.

THE WEEK IN WALL STREET.—The easier condition of the money market at the beginning of the week brought about bullish manipulation in leading stocks, but a reaction appeared toward the end. The declines were partly the result of the preceding overbuying, but were helped by the reports of the troubles in Russia, with the resulting apprehensions abroad. Local franchise stocks were subject to adverse influences, due to the uncertainties of the New York City election. The advocacy of municipal ownership of public utilities, or of repressive regulation of corporations operating under city franchises, caused marked weakness in the Metropolitan Street Railway group and other stocks of the same class. Brooklyn Rapid Transit also felt the influence of this sentiment. The industrials were the principal features of the week, the anthracite coal stocks being the chief objects of attention. American Locomotive made a new high record, and other high-priced shares were vigorously advanced. United States Steel shares were quite strong early in the week in anticipation of a favorable statement for the September quarter. The results of the week's trading in the electric industrial, traction and telegraphs are shown in the following figures: Allis-Chalmers common declined ⅝-point net, the closing quotation being 18¾ and preferred 2⅞, closing at 59¼. General Electric and Westinghouse common each closed with a net loss of 8¾ points, the last prices being 185 and 168, respectively. Westinghouse preferred, on the other hand, closed with an advance of 2½ points, the last quotation being 197. Brooklyn Rapid Transit lost 3¼ points and Metropolitan Street Railway 8¼, the closing quotations being 74½ and 119. Interborough Rapid Transit declined ¾-point net, the final figure being 211¾. American Locomotive common advanced to 71⅜ and closed at 65¾, which is a net loss of 2¾, and preferred reached 117¼, but fell to and closed at 114½, a decline of 1¼ points. Western Union is down ½, closing at 92¾, and American Telegraph & Cable made a gain of ¾ point, the last quotation being 93. Lower prices are the rule on the "curb" market. Standard Oil advanced sharply, making a total gain of 70 points within a month. The closing stock quotations of Oct. 31 are as follows:

NEW YORK

	Oct. 24	Oct. 31		Oct. 24	Oct. 31
Allis-Chalmers Co	20¾	19¼	General Electric	188¾	187¾
Allis-Chalmers Co. pfd	63¾	60	Hudson River Tel	..	..
American Dist. Tel	39¾	39	Interborough Rap. Tran	212¼	211
American Locomotive	68¾	69¾	Mackay Cos.	46	46¾
American Locomotive pfd	116	114¾	Mackay Cos. pfd	73¾	72¾
American Tel. & Cable	92	92	Marconi Tel	..	..
American Tel. & Tel	136	136	Metropolitan St. Ry	125¼	119
Brooklyn Rapid Transit	78	75¾	N. Y. & N. J. Tel	..	..
Electric Boat	30	30	Western Union Tel	92¾	93
Electric Boat pfd	70	70	Westinghouse com	174	170¼
Electric Vehicle	15	15	Westinghouse pfd	..	..
Electric Vehicle pfd	23	23			

BOSTON

	Oct. 24	Oct. 31		Oct. 24	Oct. 31
American Tel. & Tel	138	136½	Mass. Elec. Ry. pfd	56	56¼
Cumberland Telephone	122	122¾	Mexican Telephone	1¾	1½
Edison Elec. Illum	*249	*248	New England Telephone	128¼	*126
General Electric	189	188½	Western Tel. & Tel	13	13
Mass. Elec. Ry	13	13	Western Tel. & Tel. pfd	90	90

PHILADELPHIA

	Oct. 24	Oct. 31		Oct. 24	Oct. 31
American Railways	52	54	Phila. Electric	8¾	8¼
Elec. Co. of America	11¾	11	Phila. Rapid Trans	27¾	27¾
Elec. Storage Battery	84	82	Phila. Traction	..	..
Elec. Storage Battery pfd	..	..			

CHICAGO

	Oct. 24	Oct. 31		Oct. 24	Oct. 31
Chicago City Ry	200	*206	National Carbon	60	63
Chicago Edison	..	..	National Carbon pfd	118	116
Chicago Subway	..	..	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd	..	..
Metropolitan Elev. com	28¼	28			

* Asked.

GENERAL ELECTRIC STOCK INCREASE.—The General Electric stockholders will meet December 5 to vote on the proposition to increase the capital stock by the amount of $11,674,500, making the total amount $60,000,000. The increase will be used to augment working capital, which is demanded by the company's expanding business and the increasing tendency to lock up funds in the construction of large and expensive machines, such as turbo generators. The gross business for the year ending January 31, 1905, was $42,800,000, a figure which will be materially exceeded, it is said, this year.

DIVIDENDS.—The directors of the New England Telephone & Telegraph Company today declared a dividend of $1.50 per share, payable November 15. Directors have declared the regular quarterly dividend of 1¾ per cent on the National Carbon preferred stock, payable November 15. Directors of the American District Telegraph Company of New York have declared a dividend of 1 per cent, payable November 15.

WESTINGHOUSE MACHINE.—The stockholders of Westinghouse Machine Company will hold a special meeting on Dec. 23 to vote on an increase of capital stock from $5,000,000 to $10,000,000.

PORTLAND RAILWAY COMPANY.—J. & W. Seligman & Co., of this city, and E. W. Clark & Co., of Philadelphia, recently bought control of the Portland Consolidated Railway Company, of Oregon. The Portland Railway Company was incorporated on October 13 under the laws of Oregon as the successor company, with $4,000,000 common stock and $3,000,000 of 5 per cent preferred stock, cumulative from July 1, 1906. The new company has authorized an issue of first and refunding 5 per cent bonds for an amount limited to $10,000,000. Of the new bonds $5,982,000 are outstanding, $1,603,000 are reserved to retire prior liens, and $2,415,000 are reserved for additions and extensions at not more than 80 per cent of cost. The company owns 112 miles of trolley line. Of the preferred stock only $2,500,000 will now be issued, leaving $500,000 in the treasury for future requirements and improvements. Underlying bonds will be redeemed on January 1, 1906, to the amount of $982,000, reducing the amount of prior liens to $1,603,000, as above stated. The sum of $500,000 is to be expended for betterments, including double tracking at various points, heavier rails and new equipment. The new officers and directors are: F. I. Fuller, president; H. L. Clark, vice-president; C. N. Huggins, secretary and treasurer; O. F. Paxton, general counsel. Executive committee: H. L. Clark, E. W. Clark, Frederick Strauss and Ogden Mills. Other directors are A. L. Mills and J. C. Ainsworth. Redmond & Co. have purchased the $5,982,000 bonds and have resold a large portion of them. They are quoted at par and interest.

COLORADO TELEPHONE.—A circular of Moffat & White reports on the condition of the Colorado Telephone Company (Bell system): For twelve years or since 1893 it has paid 6 per cent on its stock. Last year it had a surplus of $379,153 available for the payment of the $261,249 of dividends. This was after paying 26.2 per cent. of gross for operation, 18.5 per cent for general expenses and 21 per cent for maintenance, or 65.7 per cent on these three items. The circular in part says: "While some small opposition companies exist in the territory, they have not been successful, and they are insignificant, both financially and in respect to the number of subscribers. There are no 'independent' companies in Denver or other important cities in the Colorado Telephone Company's territory. The following table shows the growth of the business for the past four years:

Dec. 31,	1901.	1902.	1903.	1904.
Real estate	$204,657	$344,401	$409,584	$421,585
Invested in plant.....	2,472,570	3,278,822	4,226,040	4,666,151
Total investment	2,677,227	3,623,223	4,635,624	5,087,736
Outstanding stock ...	2,400,000	3,400,000	4,153,550	4,354,150
Gross earnings	858,819	1,083,037	1,294,838	1,497,350
Expenses and taxes ..	625,936	771,231	977,734	1,118,196
Net	232,883	311,806	317,104	379,154
Number of subscribers	16,443	23,473	30,226	37,102

"The growth and prosperity of the company has continued during the current year, as shown by the fact that on September 30 the subscribers numbered 43,906, as against 37,102 on December 31."

CHICAGO PNEUMATIC TOOL.—We have received a copy of the report of the Chicago Pneumatic Tool Company for the quarter ended Sept. 30. It shows that earnings applicable to dividends are at the rate of about 11 per cent a year. For the nine months ended Sept. 30 earnings applicable to dividends were $441,789. This was equal to 7¼ per cent for the first three quarters, and at the rate of 10 per cent a year on the capitalization of $6,113,800. A dividend of 1 per cent quarterly is now being paid on the stock. The current earnings are equivalent to nearly 23 per cent on the market valuation of the stock, which is quoted in the Chicago market below 50. The net earnings of the company, from present indications, will exceed the earnings of either 1902, 1903 or 1904. As a matter of fact the net earnings in the first half of the present year were almost as large as reported for the entire preceding year. In 1902 they were $897,059, and in 1903, $701,464. No dividends were declared in 1904. Since the first of the year the income of the Chicago Pneumatic Tool Company has shown an increase each quarter, and the net earnings for the year may come very near $1,000,000.

MAIL TUBES IN NEW YORK.—The pneumatic tubes conveying the letter mail between New York, Brooklyn, the General Post Office and Produce Exchange and the Grand Central Station went out of service last week, when they were seized by receivers for the Tubular Dispatch Company for non-payment of $645,000 interest due on bonds. The seizure did not materially affect the mail service of the city, for the Post Office was prepared and had an extra force of wagons out to do the work as soon as the use of the tubes was denied. The Tubular Company owns the tubes, while the New York Mail & Transportation Company owns the pumping apparatus supplying the motive power. When the receivers desired to seize both the tubes and power plants the Mail & Transportation Company refused to turn the power plants over to them. The Mail & Transportation Company received an annual rental of $115,000 from the Government. The Tubular Company wanted it to pay the interest on the bonds, but the Mail and Transportation Company refused. It is a great pity a "telpherage" tube system is not put in force for this service.

MILWAUKEE ELECTRIC EARNINGS.—The Milwaukee Electric Railway & Light Company's gross earnings in September showed an increase, although amounting to only .18 per cent, but as operating expenses were cut down during the month to the extent of $6,204 the increase in net was proportionately greater than that of gross and amounted to 4.4 per cent. Other income and charges increased slightly and the net result was that the September surplus showed an increase of $5,593 as against September, 1904. For the nine months of the current fiscal year only a slight increase was shown in gross earnings, but as expenses were reduced by $36,466 with other modifications, the income account shows an increase available for dividends amounting to $37,972 and a total surplus for the nine months of $543,011. Last year the company paid the full dividend on the preferred stock of 6 per cent, making a disbursement of $270,000 and 5 per cent was paid on the common stock which required $400,675. This left a surplus of $105,829 on the operations of the year.

MEXICAN ELECTRICAL MINING.—The Colonial Securities Company of New York invites subscriptions to the $3,000,000 capital stock of the Guanajuato Amalgamated Gold Mines Company. The company, which is incorporated under the laws of New Jersey, operates the Negociacion de la Paz group of gold and silver mines at Guanajuato, Mexico. The stock is issued in shares of the par value of $5 each, and the subscription price is $2.50 a share. Subscriptions will be received at the office of the Colonial Securities Company until noon on November 10. It is stated in the prospectus that the mines are now producing large quantities of high-grade ores under the most primitive methods. The proceeds of the subscription will be used to install machinery required to operate the mines on a large and profitable scale. The change of conditions in the famous Guanajuato region has been brought about entirely by electric power, as described in these pages some time ago.

NORTH AMERICAN TELEGRAPH.—It is stated from Minneapolis that the officers of the North American Telegraph Company make the announcement that the relationship between that company and the Postal will be greatly strengthened by the transfer of stock now held by Minneapolis men. There will be no change in management and the North American will remain an independent company, but the new deal will insure a renewal of the lease, which will expire in 1911. At the recent meeting 9,000 shares of the 10,000 shares of North American were represented, and it was voted to make such an exchange pro rata of North American six per cent stock for Postal 4 per cent guaranteed preferred, as would make up the additional amount of North American desired by the Postal Company.

N. Y. & N. J. TELEPHONE.—The stockholders of the New York & New Jersey Telephone Company have authorized the increase of the capital stock from $15,000,000 to $50,000,000. It is understood that the stockholders will be allowed to subscribe to stock up to 25 per cent of their present holdings. The capital stock now issued is $13,770,100, and if the additional issue amounts to 25 per cent of that, the total capitalization will be $17,212,625. The company operates in Brooklyn and in several counties of New Jersey.

MISSOURI VALLEY ELECTRIC RAILWAY.—Denison, Prior & Co., of Cleveland and Boston, and Thomas Nevins & Sons, of this city, are offering for subscription $2,500,000, the unsold portion of the $5,000,000 underwriting of the Missouri Valley Electric Railway, which has been organized under the laws of Missouri for the purpose of constructing a high-speed electric railway on private right of way from Kansas City, Mo., to St. Joseph, Mo., as already noted in these pages.

INCREASE OF CAPITAL.—The shareholders of the Mexican Light & Power Company, at a special meeting held in Montreal, ratified the plan of the board of directors to increase the capital stock of the company. The capital has been $12,000,000, which has now been increased to $16,000,000. The increase was subsequently allowed by the federal authority.

KEYSTONE TELEPHONE BONDS.—The directors of the Keystone Telephone Company, of Philadelphia, are about to make application to list $4,000,000 of their first mortgage 5 per cent bonds on the Stock Exchange.

BONDS FOR EXTENSIONS.—Shareholders of the San Francisco, Oakland & San Jose Electric Railway will meet on December 21 to vote on creating an issue of $1,500,000 second mortgage bonds, to provide for extensions and new rolling stock.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company reports $385,102 gross for August and $143,243 net. The eight months gross is $3,005,691 and the net $1,146,116. After charges, the eight months surplus is $967,861.

MONTICELLO, GA., LIGHT BONDS.—Bids will be received until November 7 by W. J. Phillips, secretary and treasurer of the town of Monticello, Ga., for $30,000 water and light bonds.

General News of the Week

The Telephone.

FORT PAYNE, ALA.—J. W. Walker, manager of the telephone exchange, is trying to establish an electric light plant. He has secured a number of customers, and dynamos and electrical machinery will soon be purchased.

KINGMAN, ARIZ.—The Consolidated Telephone Company has secured a franchise to maintain a telephone line between Ash Fork and Kingman, to connect with the present system at Jerome and with the Kingman and Needles line, with a branch to Gold Roads.

EUREKA, CAL.—Mr. Stephen Fleming has applied for a telephone franchise from Blocksburg to Carlotta. Bids will be received for the franchise until Nov. 13.

OAKLAND, CAL.—The City Council has decided to advertise for bids on a telephone franchise, despite the opposition of the Pacific States Telephone Company. The Home Telephone Company, of Alameda County, applied for the franchise.

OAKLAND, CAL.—Within the next 30 days the Pacific States Telephone & Telegraph Company will begin the installation of an underground conduit system in this city, which, when completed, will represent an expenditure of $120,000. In addition to the underground work, the company will commence the construction of a large number of overhead lines, for the purpose of extending its system into parts of the city where the present lines are inadequate to meet the demands of subscribers. The total cost of the new work will be more than $200,000.

WASHINGTON, D. C.—The Chesapeake & Potomac Telephone Company is opening Bell exchanges in Maryland at Kensington, Woodlawn, Mt. Airy, New Windsor, Taneytown and Union Bridge.

GRIFFIN, GA.—The Council of Griffin has named a committee to investigate the alleged deficient service of the Southern Bell Telephone Company.

SAVANNAH, GA.—At the lighting plant on Indian street extensive improvements are now under way. Considerable new machinery is being put in, which will double the capacity of the plant.

NAMPA, IDAHO.—The Bell Telephone Company will install a new switchboard here and inaugurate numerous other improvements to its system.

HUTSONVILLE, ILL.—The Hutsonville Telephone Company has been organized with a capital stock of $5,700, by C. D. Ryerson and C. H. Voorheis.

ANGOLA, IND.—The Steuben County Electric Telephone Company has increased its capital from $5,000 to $100,000.

BROWNSTOWN, IND.—The Brownstown Telephone Company has closed a deal with the Union Telephone Company by which it has placed in service sixty or more telephones.

LAFAYETTE, IND.—The Lafayette Telephone Company (independent) has purchased a large building here and will expend several thousand dollars remodeling it for a new exchange. The company will install new equipment and otherwise improve its plant in the new home.

WARSAW, IND.—During the past two years the Commercial Telephone Company has made rapid progress, having increased from 200 to 750 subscribers. The company has installed a new switchboard, completely renovated its outside construction, and in addition to paying all obligations, has accumulated a surplus.

MARION, IND.—A new telephone company has been formed with headquarters in this city. The directors include members of the Winchester, the Fort Wayne, the Delaware & Madison County and other independent telephone companies. The company formed and soon to be incorporated is said to be backed by large capital and its purpose is to install in Marion one of the best automatic plants that can be purchased. Long-distance lines will be built to connect with nearby cities and towns. A franchise has been prepared and made public, which will be submitted to the Council at its next meeting. The company agrees to place all wires under ground in the business part of the city, and all wires in the resident part in cables. Business men and the people generally are urging the Council to grant the franchise because present conditions are unsatisfactory. This move means another telephone war or a fight for at least a large share of the business in Marion as against the present consolidation of the Central Union and United Telephone Company. The merchants claim the latter have cut them off from all connection with the independent long-distance lines, much to their detriment.

INDIANAPOLIS, IND.—A meeting was held in this city on Oct. 26 by the Breckenridge Jones' interests of St. Louis, and by the Stifel-Brailey interests of St. Louis and Toledo, whereby the property and control of the Indianapolis Telephone Company and the New Long Distance Telephone Company were turned over to them. This action was foreshadowed in ELECTRICAL WORLD AND ENGINEER of Oct. 28. The reorganization consisted simply of the election of new officers, as follows: For the Indianapolis Telephone Company, H. C. Stifel, of St. Louis, president: Jas. S. Brailey, of Peru, vice-president; John H. Holiday, of Indianapolis; A. H. Bauer and B. A. Althemier, of St. Louis, directors. Messrs. Jones and Volker, of St. Louis, and Messrs. Stifel, Brailey and Foster, of Toledo, voting trustees. The officers of the New Long Distance Telephone Company, H. C. Stifel, president; C. M. Foster, vice-president; Breckenridge Jones, of St. Louis; J. S. Brailey, of Toledo; A. F. Ramsey, of Crawfordsville; M. B. Wilson and Louis Hollweg, of Indianapolis, directors. There will be no change in the local management of the two companies. H. B. Sales will remain as secretary and general manager. President Stifel announces that the companies will continue separate operation, and that a large sum will be expended each year in making improvements and extensions. The St. Louis and Toledo people have also secured the property of the Terre Haute Telephone Company. These movements are the foundation for the belief that there is to be a gigantic merger of the independent companies of the Middle West with the independents of the East and the West.

JAMES, IA.—The James Telephone Company has been organized. Henry Junck is president; Frank Woolworth, secretary and treasurer.

DAVENPORT, IA.—The annual meeting of the stockholders and directors of the American Telephone & Telegraph Company of Iowa has been held and officers were elected as follows: President, E. P. Meany, of New York; secretary, Melville Egleston, of New York; treasurer, J. C. Vail, of New York.

DES MOINES, IA.—During the past year the telephone mileage of Polk County, Ia., has increased very rapidly and figures supplied to Auditor Burnett show that the present year's mileage amounts to 978.78, whereas last year it was but 306. The Mutual Telephone Company, of Des Moines, is the heaviest taxpayer with 104 miles at $384.60 per mile, a total of 39,998, and the Jasper County Telephone System comes next with 187 miles, paying a tax of $12,108.25.

SIOUX CITY, IA.—Construction work on the new independent toll telephone line, which is to connect Sioux City, Yankton and Sioux Falls, has been started. The cost of the lines will be $250,000. They will be built by the three independent companies, the Yankton Telephone Company, owning the lines from Yankton to Sioux Falls and west from Yankton to Tyndall; the Missouri River Telephone Company, owning the lines through the counties west from Tyndall to Bonesteel, and the Chamberlain, Mitchell & Citizens' Telephone Company, of Sioux Falls, having lines to Canton, Salem, Dell Rapids and Worthington, and connections with the Twin City Telephone system.

WELLINGTON, KAN.—The Bell and Independent Telephone Companies at Wellington have come to an agreement. The Bell has retained the toll line business.

PARSONS, KAN.—A charter has been granted the Citizens Home Telephone Company, a corporation with a capital of $500,000, organized for the purpose of taking over and consolidating all the independent telephone companies in Southeastern Kansas. James Plottner, George Yeager and others are the incorporators.

DENMARK, ME.—The Denmark Telephone Company has been formed with a capital of $10,000, by E. L. Head, president; O. L. Wentworth, clerk.

LEOMINSTER, MASS.—It has been voted by the executive committee of the directors of the Worcester Consolidated Street Railway Company to enlarge the power house at Leominster at a cost of $6,000. An addition is to be made to allow room for the new machinery for power for the Worcester & Leominster line, now in process of construction.

DETROIT, MICH.—Michigan is to be invaded by another big telephone company, according to Detroit reports. It is claimed that the men interested have $5,000,000 to invest in the enterprise.

BENTON HARBOR, MICH.—The Twin City Telephone Company, in this city, and the Bell Company, in St. Joseph, have decided to put their wires in the business portions of these two cities underground.

DETROIT, MICH.—The Michigan Telephone Company has under consideration the placing of the Michigan Avenue lines in conduits early next year, and will lay about ten miles of underground work in that thoroughfare.

WEXFORD, MICH.—Farmers of this township have organized a rural telephone company. The central office will be located in the village of Sherman. It is expected eventually to extend the lines a distance of 25 miles in various directions.

MANISTIQUE, MICH.—Through the efforts of business men in the two cities it is possible that the construction of a telephone line between Manistique and Escanaba will be undertaken by the Michigan State Telephone Company, this fall.

SHELBY, MICH.—Shelby, Ferry and Elbridge farmers are preparing to string a telephone line to Shelby, which is to be a part of the system of the Oceana Farmers' Mutual Telephone Company. This company has a contract with the Bell Company to furnish exchange service at Shelby, Hart and Pentwater.

NEW PRAGUE, MINN.—The Tri-County Telephone Company has been formed with a capital of $1,000,000, by S. A. Votapek and Albert Eybak.

BILLINGS, MONT.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Billings, until Dec. 15, for installing a telephone system, with eight or more telephone stations, and 22 miles or more of pole line.

FORSYTH, MONT.—The Forsyth Telephone Company, capitalized at $20,000, has filed articles of incorporation with the county clerk. A line will at once be constructed as far as Miles City. The incorporators are: J. E. Edwards, C. M. Blair and Frederic Collins.

JOPLIN, MO.—The Home Telephone Company has made plans to absorb the Southwestern Missouri Telephone Company's system..

CARL JUNCTION, MO.—The Spring River Mutual Telephone Company, of Carl Junction, has been given permission to build a telephone line on the public highway from Carl Junction through Waco to Asbury.

ST. LOUIS, MO.—St. Louis officers of the United States Independent Telephone Company, which was recently organized in Rochester, N. Y., were, on Oct. 25, chosen officers in the Indianapolis Home Telephone Company. They are James P. Bradley, jr., vice-president, and John Holliday, Benj. Altheimer and A. Bauer, directors. The Long-Distance Telephone Company elected

the following-named officers: Herman Stifel, president; Marquard Forster, vice-president, and Breckenridge Jones, A. F. Ramsey, M. B. Wilson and Louis Hollweg, directors.

CENTRAL CITY, NEB.—The Nebraska Telephone Company is preparing to rebuild its lines at this place. Between $10,000 and $15,000 will be expended.

ODESSA, N. Y.—The Odessa Telephone Company has been organized with a capital of $5,000, by Elmer Sherwood and Dwight Sherwood.

ALBANY, N. Y.—An ordinance has been passed requiring the Hudson River and the Home Telephone Companies to place their wires in this city in underground conduits.

CORNWALL, N. Y.—The Cornwall Telephone Company has been incorporated by W. B. Goodwin, Learned Hand and G. Morrell, of New York, directors. The capital is $5,000.

TICONDEROGA, N. Y.—The Ticonderoga Home Telephone Company has been formed. Capital, $25,000. Incorporated by Robert N. Clemons, Dresden Station, N. Y., and others.

BUFFALO, N. Y.—In all probability the Home Telephone Company and the Interoceanic Telephone Company, of Buffalo, will join hands in the laying of the conduits throughout the center of the city to care for all wires. The question of conduits seems to be practically settled. All the wires in the business section are to be accommodated. A twenty-duct conduit is proposed for Main Street. Two and one-quarter miles in all will probably be built at an expense of $40,000.

TOLEDO, OHIO.—The Wood County Telephone Company has increased its capital from $200,000 to $300,000.

AUSTINBURG, OHIO.—The Austinburg Telephone Company has been formed. Capital, $5,000. Incorporated by F. M. Houghtaling and Tracy Herrick.

MOUNT BLANCHARD, OHIO.—The People's Telephone Company has increased its capital stock from $50,000 to $100,000. F. E. Palmer is president.

WOOSTER, OHIO.—The Wooster, Millersburg & Orrville Telephone Company will enlarge its quarters to accommodate its rapidly increasing business.

WINDSOR, OHIO.—The Windsor people are planning a local telephone company and want to get connection with Jefferson. The cost for annual rental of the telephones in Windsor will be about $3.

BRYAN, OHIO.—The Bryan Telephone Company, of this place, has purchased the plant of the Pioneer Telephone Company, of Pioneer, operating something over 100 telephones.

LIMA, OHIO.—The seventh district of the Ohio Independent Telephone Association, composed of Allen, Auglaize, Marion, Wyandot, Hancock, Putnam, Paulding, Van Wert, Mercer and Hardin counties, met in semi-annual session here, October 5, with representation from each of the forty-one companies in the district.

ZANESVILLE, OHIO.—At a special meeting of the stockholders of the Zanesville Telephone & Telegraph Company, $50,000 was voted for extensive improvements to the company's property in the city during the next year. This $50,000 will be expended to lay more of the vitrified conduits in the city streets, extending the already extensive underground system of wires; also in the extension of cables. The single wire lines will also be greatly extended at the same time. All this improvement contemplated will accommodate 1,000 to 1,500 new subscribers.

ALLENTOWN, PA.—The Consolidated Telephone Company, of Allentown, Pa., has decided to spend $200,000 in installing automatic telephone plants in this city, and in Hazelton.

PIERRE, S. D.—The local telephone exchange has been sold and Manager Zietlow and Secretary Bilkenhaupt are now the owners. Connections are to be made with the Twin Cities.

DALLAS, TEX.—The Texas Independent Telephone Clearing House Association has been organized and application has been made for a charter. The promoters will proceed to organize the various independent long-distance companies under one head for mutual benefit. The incorporators are: E. W. Dunaway, A. J. Brown, C. L. Simpson, J. E. Boynton, G. R. Butler and C. A. Shock.

PRICE, UTAH.—An arrangement has been entered into between the Utah Telephone Company and the Bell Company, whereby the lines of the two companies are to connect in this city.

WILLIAMSBURG, VA.—The Chesapeake Telephone & Telegraph Company, of Williamsburg, has passed into the control of the Bell Telephone Company. The purchase is said to give the Bell control of the system from Norfolk to Richmond.

PARKERSBURG, W. VA.—The Citizens Telephone Company, which has lines all through the lower end of the county, and is seeking connection with this city, has been granted permission to set its poles along the public highway.

DE PERE, WIS.—The Telephone Company has inaugurated its service in De Pere. The company is extending the line to Kaukauna, by way of Greenleaf and Wrightstown.

MILWAUKEE, WIS.—Mr. Harold D. Stroud, of St. Louis, has applied to the City Council for a telephone franchise. This is the fifth independent company to aply for a franchise. The company proposes to charge 2 cents per call and allow reductions on a certain number of calls.

LA CROSSE, WIS.—All the electricians and linemen of the four telephone companies centering here struck on Oct. 23 for recognition of the union. The companies are paying the union scale and working union hours, but the question of open or closed shop is the point in controversy. The Wisconsin Telephone Company and the La Crosse Telephone Company are concerned. The La Crosse County Telephone Company, the Tri-State Telephone Company, and several interurban lines are less seriously affected.

Electric Light and Power.

GRAVETTE, ARK.—G. W. Dunbar, of Gravette, is interested in the construction of an electric light plant, street railway and water works.

PASADENA, CAL.—The Valley Electric Company has been incorporated with a capital of $500,000, by R. F. Davis, E. A. Miller, of Pasadena, and others.

VISALIA, CAL.—A. G. Wishon has applied for a franchise to erect poles and wires for transmitting electric power and for telephone wires along streets and highways in Tulare County. Bids for the franchise will be received by E. L. Scott, county clerk, Nov. 10.

SAN FRANCISCO, CAL.—Arrangements have been completed for the financing of the Stanislaus Electric Company, which was recently incorporated to establish an electric power station on Stanislaus River, and furnish electric light and power to Stockton, San Jose, San Francisco and intermediate points. Leopold Michaels, president San Francisco Gas & Coke Company is reported interested.

SPARTA, GA.—The citizens have voted in favor of issuing $12,000 bonds to establish an electric light plant.

ATLANTA, GA.—R. L. West, of Atlanta, is among the promoters of the Etowah River electric power development, between Rome and Cartersville, Ga.

ATLANTA, GA.—The Southern Light & Power Company has decided to issue $500,000 bonds, to be used for the construction of an electric plant in or near Atlanta, for the purpose of furnishing power in Fulton and DeKalb counties.

PARIS, ILL.—The Paris Gas & Electric Company has been reorganized with Wm. Hunter, of Paris, as president, and J. C. Shumway, of Taylorville, secretary, and will issue $20,000 bonds to make improvements.

CHICAGO, ILL.—The City Council on Oct. 23 passed a resolution authorizing the commissioner of public works and the city electrician to prepare estimates of cost of securing electric power from the water power of the drainage canal; also authorizing the finance committee to make the necessary appropriation for use of this power.

ZIONSVILLE, IND.—The Zionsville Lumber Company is preparing to install an electric light and power plant in connection with its large planing mill.

GENEVA, IND.—Wm. R. Thurston, of Berne, Ind., has been granted a franchise to build an electric light plant in Geneva. A stock company is being organized by Mr. Thurston.

VINCENNES, IND.—John Fries, Wm. Bolk and H. H. Osterhage are heading a company to build a large ice plant and cold-storage house. The company will also, it is understood, install an electric plant.

EVANSVILLE, IND.—The Evansville Gas & Electric Light Company has entered into a contract to furnish electric power for three of the interurban roads running into Evansville, with a possibility of securing a similar contract for the fourth line. Extensive additions are being made to the company's plant in order to supply the needed power. The company estimates that it will expend upwards of $130,000 on these improvements.

SHELBYVILLE, IND.—By direction of the United States Court, the property and business of the Citizens' Water & Light Company, of Shelbyville, has been transferred back to the company. A mortgage for $50,000 on the plant has been given to the United States Mortgage & Trust Company. The directors are now planning to make extensive improvements.

INDEPENDENCE, IA.—The city officials are considering plans for the improvement of the electric light plant.

PAOLA, KAN.—The citizens have voted to issue $25,000 to construct an electric light plant.

GEARY, KAN.—The Geary Electric Light & Power Company has been incorporated with a capital of $5,000. Directors: Chas. F. Dyer, I. J. Robb and J. M. Robb, all of Bridgeport.

DEXTER, ME.—The Dexter Electric Light Company has passed into the control of N. Curtis Fletcher, of Boston. It is understood that the service will be extended and improved.

NORTH ANSON, ME.—The Carrabassett Stock Farms Company has completed the dam at East New Portland, preparatory to installing an electric light plant to furnish light for this village.

BIDDEFORD, ME.—The estimated cost of wiring the buildings of the Pepperell Manufacturing Company is estimated at $16,000. The York Light & Heat Company will expend $42,000 at the power station in increasing the lighting capacity. It is estimated that the cost to the electric light company of running wires, etc., from the station to the mill entrance will be $10,000.

BALTIMORE, MD.—The Board of Awards has approved the plans of Subway Engineer Phelps, for special duct pipe and underground cable.

AMHERST, MASS.—The Amherst Gas & Electric Light Company will extend its service to West Pelham.

QUINCY, MASS.—The City Council has been petitioned for the right to establish a municipal gas and electric lighting plant.

HAVERHILL, MASS.—The Haverhill Electric Company has petitioned the city to share the expense of placing its wires underground.

PITTSFIELD, MASS.—The Great Barrington Power Company has awarded to the Stanley Company, of this city, the contract for generators and electrical equipment. The contract amounts to about $13,000.

LEOMINSTER, MASS.—Extensive repairs and improvements are to be made at the Leominster Electric Light & Power Company's plant on Mechanic Street, which is now owned by the Massachusetts Lighting Company.

FITCHBURG, MASS.—The committee on fuel and lighting streets reported an agreement with Fitchburg Gas and Electric Light Company to furnish

incandescent lights in all city buildings at 12 cents per kilowatt-hour, a cheaper rate than is now paid.

WORCESTER, MASS.—The Worcester Electric Light Company has sent a petition to the Gas and Electric Light Commission requesting permission to increase the capital stock of the company $200,000, the purpose of the increase being to provide funds for additions to the plant.

LYNN, MASS.—The Street Lighting Committee has signed the contract with the Lynn Gas and Electric Company for lighting the town for the next five years. An important provision in the contract is one relating to a municipal plant, as it provides that the contract shall cease at any time during the term of five years for which it is made, if, by the vote of the town, a municipal plant should be established.

MALDEN, MASS.—At a meeting of the Malden and Melrose Gas Light Company, the entire stock of the company was sold to a syndicate representing the Malden Electric Company, which will consolidate the companies. The directors of the new company are also directors in the Springfield Gas Company and in the Malden Electic Company. They are A. B. Tenney, Brookline; E. A. Hildreth, Cambridge; F. P. Royce, Dedham; C. H. Tenney, Hartford; H. P. Wood, Boston; Oakes Ames, Milton; S. A. York, E. M. Bradley and H. E. Warren, all of New Haven. The treasurer will be A. B. Tenney and Horace P. Wood will be clerk. The new company will take immediate action to improve the service and will make extensive repairs.

SALEM, MASS.—The street lighting contract expired the first of October, but as it contained a provision that it might be continued for six months without a new contract, there is no danger of the city being obliged to pay an extra price or going without lights before April 1, at least. The committee on street lighting is collecting data of what other places are paying for lights and the quality of the light, and proposes to place the whole matter before the City Council with the figures offered by the local company. There is a strong element in the Council in favor of returning to the open arc system, as it is claimed that the city was better lighted under that system and the apparent saving made by the change has been offset by the increased number of lights required.

MUSKEGON, MICH.—The Grand Rapids & Muskegon Electric Water Power Company has petitioned for a franchise to furnish the city with electric light and power.

MANISTEE, MICH.—The Manistee River Power Company has petitioned for permission to dam the river near Sherman and erect a power house about 1 mile east of that village. Traverse City, Manistee and Cadillac, it is stated, are to be furnished with light and power and the plant is to be capable of developing 3,000 horse-power. A meeting of the Board of Supervisors is to be held Nov. 15 at Cadillac to consider the petition.

LUDINGTON, MICH.—The County Board of Supervisors has granted to the Pere Marquette Light & Power Company a permit to erect a dam on the south branch of the Pere Marquette River in Mason County. J. H. Cotton is president of the company and George S. Root, vice-president. It is understood that the company intends to furnish power and light to Hart, Scottville, Custer, Pentwater and other towns.

FOLEY, MINN.—O. F. Doyle has submitted an estimate to the citizens of Foley, estimating the cost of a water works and an electric light plant at a total of $13,144.

STARKVILLE, MISS.—Bonds to the amount of $8,000 have been sold for extending the water and light plant.

DILLON, MONT.—The electric power plant of the Dillon Electric Light & Power Company is being improved at an expense estimated at $10,000.

WARSAW, MO.—W. S. Davis, City Clerk, writes that bids are wanted Nov. 10 for the construction of an electric light plant.

RENO, NEV.—A movement is being made by the City Council toward the municipal ownership of the holdings of the Reno Power, Light & Water Company, and it is believed that some such deal will be consummated in the near future.

MEREDITH, N. H.—It is reported that the plant of the Meredith Electric Company has been purchased by the Laconia Electric Light Company, and the power station here is to be discontinued. It is said to be the intention of the new management to extend the wires from Lakeport to Meredith, a distance of about 6 miles.

NEWARK, N. J.—A special committee of the Board of Public Works has recommended that a municipal electric light plant be established to light that part of the city north of the Lackawanna Railroad. The Belleville pumping station is the suggested location of the plant, which will have a capacity of 500 lights.

ASHTABULA, OHIO.—The superintendent of the electric light plant has petitioned the finance committee for an appropriation of $7,250 for improvements to the electric light plant.

MANSFIELD, OHIO.—The stockholders of the Mansfield Electric Light & Power Company have chosen directors. The following officers were elected by the board of directors: President, C. W. Upson; vice-president and treasurer, J. J. McIntyre; secretary and superintendent, W. C. Hedges.

LEBANON, PA.—Geo. R. Hersey and Eli Nisley have secured an electric light franchise.

HUNTINGDON, PA.—The Juniata Water & Water Power Company has increased its capital for $5,000 to $75,000. It is stated to be the purpose of the company to construct a plant on Juniata River, near Huntingdon, for the generation of electric power.

DANVILLE, PA.—The date of opening of bids for the erection of a power house, electric generator plant, engines, boilers, motors, etc., and wiring the Administration Building, Wards, etc., at the State Hospital for the Insane, has been extended from Oct. 27 to Nov. 10. Address all bids to Dr. Levi I. Shoemaker, Chairman Building Committee, Board of Trustees, State Hospital for the Insane, care of Dr. H. B. Meredith, Superintendent.

EDGEFIELD, S. C.—It is proposed to install an electric light plant here.

BISHOPVILLE, S. C.—The corporators of the Bishopville Light & Power Company have secured a charter from the State of South Carolina.

GREENVILLE, S. C.—Jos. E. Sirrine, of Greenville, is the engineer for the $750,000 electrical power development for the Hatton's Ford Power Company, near Anderson, S. C.

LAWRENCEBURG, TENN.—The citizens have voted to issue $25,000 bonds for the construction of water works and an electric light plant.

KNOXVILLE, TENN.—The City Council has authorized the Board of Public Works to award to the Knoxville Railway & Light Company a contract for 303 or more arc lights at a cost of $72.50 per light per year for a period of 10 years.

COALVILLE, UTAH.—The City Council has awarded a contract to Thomas L. Allen for an electric power plant in this city.

SHENANDOAH, VA.—Mayor S. D. Louderback will receive bids until Nov. 14 for an electric light and power franchise.

FORT D. A. RUSSELL, WYO.—Bids will be received by Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, until Dec. 2 for furnishing and installing electric fixtures in certain buildings and for extending the lighting system at Ft. D. A. Russell.

LETHBRIDGE, ALBERTA, CAN.—A by-law will be introduced in the City Council favoring the purchase by the city of the electric light plant and the telephone system, and operate both under municipal ownership.

WINNIPEG, MAN.—The Great Falls Power Company proposes to develop the power at Big Bonnet Falls. Duncan Sinclair, Winnipeg, is secretary of the company.

The Electric Railway.

TUSCALOOSA, ALA.—A. J. M. Dewberry and others have secured a franchise from the town of Tuscaloosa, to operate an electric railway in the town and in Jefferson county. It is proposed to build the line from Birmingham to tidewater, furnishing a cheaper rate on iron and other products.

DOWNIEVILLE, CAL.—Rights of way have been secured for the new electric railway from Sierraville to Beckwith. The entire valley will also be supplied with electric power as soon as the power plant can be erected.

SAN FRANCISCO, CAL.—W. R. Hawley, assistant general manager of the Crown Paper Company and bankers Rhodes, St. Clair and Butcher, of Philadelphia, are interested in water rights on the Santiam River in middle western Oregon, and propose to build an electric railway from Portland to Salem. This will probably be extended in time to Eugene and Roseburg. The Philadelphians acquired interests in the lighting at Salem and Eugene.

SAN FRANCISCO, CAL.—The Ocean Shore Railway Company has filed amended articles of incorporation, increasing its capital stock from $3,000,000 to $5,000,000, the greater sum being required for the construction and equipment of the road now being built from the Richmond district in this city to Halfmoon Bay and Santa Cruz. Contracts for the electrical equipment of the power house and substations of the company were recently awarded to the General Electric Company, while Chas. C. Moore & Company secured contracts for the steam equipment.

SAN FRANCISCO, CAL.—At the annual meeting on Oct. 16 of the Vallejo, Benicia & Napa Valley Railroad, it was decided to extend the line to St. Helena and Calistoga. The company expects to spend several million dollars in extensions and improvements within the next three years. All the present officers were re-elected except the general manager. To that position L. F. Perry was chosen. It is probable that the general offices of the road will be removed from Los Angeles to San Francisco and later to one of the terminal points.

WATERBURY, CONN.—The Thomaston Tramway Company and the Connecticut Railway & Lighting Company have entered into an agreement to have the street railway line between Waterbury and Thomaston constructed not later than July 1, 1906. The two sections of road will effect a junction at the boundary line between the city of Waterbury and the town of Thomaston.

OTTAWA, ILL.—The Illinois Light & Traction Company, of Streator, has been incorporated with a capital stock of $400,000. The shareholders are I. H. Sherwood, W. V. Coons and Fred Edwards.

CROWN POINT, IND.—The Northwestern Indiana Interurban & Street Railway Company, of this city, has filed articles of incorporation, capitalized at $10,000. The directors are Geo. M. Bliss, Frank C. Knight and W. B. Wray.

MASON CITY, IA.—The Mason City & Clear Lake Traction Company has let contracts for machinery for a new power station. The Westinghouse Company will furnish the electrical equipment.

SPRINGFIELD, MASS.—At the annual meeting of the Connecticut Valley Street Railway the following officers were elected: President, Col. F. E. Pierce, of Greenfield; secretary and treasurer, D. P. Abercrombie, jr., of Turners Falls; superintendent, J. A. Taggart, of Millers Falls.

SPRINGFIELD, OHIO.—Judge Kunkle has authorized Stacey B. Rankin, receiver of the Springfield, South Charleston, Washington C. H. & Chillicothe Traction Company, to sell the property.

STEUBENVILLE, OHIO.—The Steubenville & Wellsburg Railway Company has been granted a franchise over certain streets in Steubenville. The company will operate a line from Steubenville to Wellsburg and Follansbee, W. Va.

NELSONVILLE, OHIO.—The Nelsonville, Athens & Glouster Traction Company is securing right of way for a line between Athens, Nelsonville, Buchtel and Glouster, all mining towns. The promoters of the company are L. F. Carpenter, T. E. Wells, Charles Lutt, B. C. Wise and others, of Nelsonville.

COLUMBUS, OHIO.—The following directors have been elected for both the Columbus, Buckeye, Lake & Newark Traction Company and the Columbus, Newark & Zanesville Electric Railway Company; W. K. Schoepf, Hugh McGowan, George H. Warrington, J. B. Foraker, jr., Dana Stephens, Randall Morgan and T. H. Dickson. The officers selected were: President, W. K. Schoepf; vice-president, Hugh McGowan; secretary-treasurer, F. A. Deverall. The executive and transfer offices of the companies have been removed from Boston to Cincinnati.

OREGON CITY, ORE.—W. P. Hawley, a local capitalist, states that Eastern capital is preparing to build an electric rialway from Portland to Roseburg; the first section, from Portland to Salem. The proposed road will go to Eugene and south by a route yet to be determined, to Roseburg.
the solicitors.

POTTSTOWN, PA.—The Ringing Rocks Electric Railway Company has passed into the hands of the Security Company, of Pottstown, trustee for the bondholders. The mortgage on the road has been foreclosed and execution issued, and after three months have elapsed it will be sold. It was the intention of the owners of the road, who are principally Pottstown business men, to extend the line to Boyertown, but the objections of a few obstinate property holders held up the line and prevented the company from carrying out its plans.

MORGANTOWN, W. VA.—W. W. Smith, of Morgantown, attorney for the Morgantown & Dunkard Valley Railroad Company, writes that it is proposed to construct an electric railway 42 miles in length from Morgantown to Mannington. The probable cost of the work is $300,000 to $500,000. Prof. C. R. Jones will have charge of the electrical part of the work. Bids will be called for in 60 to 90 days.

ST. CATHERINES, ONT.—Application will be made to the Parliament of Canada for an act to incorporate a company to be called the Buffalo, Niagara & Toronto Electric Railway Company, Collier & Barson, of St. Catherines, are

New Industrial Companies.

THE TUDOR FARM MOTOR CAR COMPANY, of Sharon, Mass., has been formed with $15,000 capital, by Dorsey L. Greene, Emil Camus and James H. Whipple.

THE AUTOMATIC PROTECTION COMPANY has been incorporated at Jersey City with a capital of $100,000. Incorporators: Louis B. Dailey, Thomas F. Barrett, and L. H. Gunther.

THE HUTCHISON ELECTRIC HORN COMPANY, of Ossining, N. Y., has been incorporated with a capital of $20,000. The directors are M. R. Hutchison and W. M. Williams, of New York, and P. J. Pierson, of Ossining.

THE BRUCE ELECTRIC COMPANY, of Columbus, Ohio, has been incorporated with $25,000 capital stock, by Robert L. Bruce, J. B. Addison, George C. McKeever, Lewis G. Addison and Charles Munson. The company will deal in all kinds of electrical and glass supplies and fixtures.

THE MOUTERDE ELECTRIC ACCUMULATOR COMPANY has been incorporated at Montreal, Que., with a capital of $250,000 for the purpose of manufacturing accumulators, meters, motors, etc. The directors are: Francois Mouterde, Montreal; J. G. Ryan, New York; J. S. Visger, Denver, Col.

THE JONES & MOORE ELECTRIC COMPANY has been incorporated at Winnipeg, Man., with a capital of $75,000, to deal in electrical machinery and supplies. The directors are: J. W. Jones, Toronto, Ont.; G. J. Hicks, L. M. Delbridge, J. C. Kavanagh and C. W. Bradshaw, all of Winnipeg, Man.

THE RAIL JOINT COMPANY was organized last week by filing a certificate of incorporation. It has a capital stock of $1,500,000, of which $1,000,000 is common and $500,000 preferred. The officers of the company are: President, Frederick T. Fearney; vice-presidents, Lawrence F. Braine and Percy Holbrook; treasurer, Fernando C. Runyon; secretary, Benjamin Wolhaupter. This company will take over the business and properties of the Continuous Rail Joint Company of America, the Weber Railway Joint Manufacturing Company and the Independent Railroad Supply Company.

Legal.

WIRELESS LITIGATION.—Judge Townsend, in the United States Circuit Court, sitting in New York City, last week, refused to vacate an order issued on May 20 at the instance of the De Forest Wireless Telegraph Company, suspending the injunction granted against the Marconi Company in its suit against the De Forest Company for alleged infringement of patents. Last May Judge Townsend handed down an exhaustive opinion in the case rejecting the Marconi Company's broad claim covering the entire wireless telegraph field, but at the same time sustained that part of the Marconi Company's contention relating to the construction of the elevated structure used in sending and receiving messages. Upon this latter finding an injunction was issued, but the defendants got an order suspending the operation of the injunction pending an appeal. Recently the Marconi Company attempted to have this last order vacated, which Judge Townsend by his latest order denies. The final outcome of the case rests with the decision of the United States Court of Appeals.

Obituary.

MR. GEORGE C. BAILEY, secretary and treasurer and Chicago manager for twenty years for the John A. Roebling's Sons Company, died at his residence, 5224 Jefferson Avenue, Chicago, on Oct. 28. Mr. Bailey was born in 1843 and was with the John A. Roebling's Sons Company for eight years before he went to Chicago to establish a branch there in 1885. His wife and two children survive him. He was a member of the Union League Club of Chicago. Funeral services were held in Chicago October 30.

Personal.

MR. H. H. WESTINGHOUSE, at the annual fall meeting of the board of trustees of Cornell University, was elected one of the trustees.

MR. C. E. CHISHOLM has been appointed superintendent of the Suburban Gas & Electric Company, of Revere, Mass., which has a large electric light plant.

MR. C. H. HINES has been appointed master mechanic and chief engineer of the Tezuitlan Copper Co., Tezuitlan, Puebla, Mexico, and has assumed his new duties.

MR. ARTHUR WARREN has resigned his position as manager of publicity for the Allis-Chalmers Company, and will sail for Europe on a journalistic mission about the end of November.

MR. A. H. BURTON has started the electrical construction and contracting firm of A. H. Burton & Co. at South Norwalk, Conn., and has already on hand a large number of wiring contracts for new buildings and residences.

MR. ANDREW PINKERTON has resigned as electrical engineer of the Vandergrift-Apollo Works of the American Sheet-Steel Company, in order to enter into partnership with George P. Dravo, of Milwaukee, the firm to engage in consulting engineering and contracting.

MR. WARREN F. HUBLEY, until recently representative of the Sunbeam Incandescent Lamp Company, at Philadelphia, Pa., has resigned in order to accept the position of Western representative of the American Transformer Company, of Newark, N. J. His headquarters will be with the Western Electric Company, Chicago, Ill.

MR. LEWIS B. STILLWELL has been appointed consulting electrical engineer of the New York, Westchester and Boston Railway Company, effective Nov. 1, 1905. He will advise the chief engineer in all matters pertaining to the electrical and mechanical equipment, and will generally direct the work of the electrical department.

FIRST LIEUT. A. C. VORTS, U. S. Signal Corps, has been relieved from further operations in special orders of August 21st, and will make during the fiscal year ending June 30, 1906, three visits from St. Michael to Nome, six visits to Safety Harbor, and one visit to Kaltag, Alaska, on business pertaining to wireless telegraphy system of Alaska.

MR. S. E. WOLFF has been appointed assistant general manager of the Saginaw-Bay City Railway & Light Company. Mr. Wolff has for a number of years been manager of the Jackson Gas Company. The place of assistant general manager is newly created. Mr. Wolff had been with Hodenpyl, Walbridge & Co. for a period of about twelve years and he is everywhere recognized as one of the best experts in his line.

MR. MAX LOEWENTHAL, who of late years has devoted his attentions and energies as an electrical engineer to the development of electric heating, has undertaken as a specialist the creation and development of a heating department for the Edison Electric Illuminating Company, of Brooklyn. Such an experiment is well worth the making by every local lighting company, and Mr. Loewenthal's work will be followed with deep interest.

MR. H. S. PUTNAM has been appointed electrical engineer of the New York, Westchester and Boston Railway Company, effective Nov. 1, 1905. He will have entire charge of the electrical department as organized in the office of the chief engineer; will report directly to the chief engineer, will supervise the work of the electrical department, and see that it is carried out along the lines as suggested by the consulting engineer.

MR. H. H. VREELAND has been visiting Minneapolis, and while there said: "In my belief, the day will soon come when every street running north and south in New York City, will be provided with its surface, subway and elevated lines. Even then it is doubtful if the increased facilities will care for the enormous travel that the growth of the city brings with it every year. As fast as possible the problem is being worked out with new subways and elevated lines."

MR. C. T. YERKES.—A cable dispatch from London of October 28 says: "Mr. Charles T. Yerkes is back in London, entirely recovered from the mysterious illness which caused such a sensation last July. He laughed merrily when told of the supposed contents of the will he was reported to have made. Whether or not he has bequeathed his priceless art treasures to the Metropolitan Museum in New York he altogether refused to say. "If the people want to know what is in my will," he said, "they will have to wait till I am under the turf, and I can only hope their charity is as strong as their curiosity."

MR. CHARLES W. WETMORE, president of the North American Company; Edwin M. Bulkley, of Spencer Trask & Co., a Director, and C. D. Smithers, of F. S. Smithers & Co., have just returned to New York City from a trip of inspection of the properties of the important subsidiary companies of the North American Company—the United Railways, Union Electric Light and Power, and Laclede Gas Companies of St. Louis; the Milwaukee Railway & Lighting Company and Milwaukee Light, Heat & Traction Company, and the Detroit Edison Company. All were found to be in greatly improved condition.

MR. JOHN F. TINSLEY, assistant electrical engineer, Signal Corps, U. S. Army, has resigned from the service to become associated with the American

Steel & Wire Company. Mr. Tinsley graduated from the electrical engineering department of Rutgers College, with the degree of Bachelor of Science in the class of 1900, taking first honors. Previous to his appointment to the engineering staff of the Signal Corps, early in 1903, he was connected with the Western Electric Company, in New York, and later with the United Electric Company, of New Jersey, in engineering work. In the Signal Corps, Mr. Tinsley has been connected with some of the most important work of that branch of the service, notably the Alaskan submarine cable work. For some time past he has been the Signal Corps engineer for the Department of California, where he was associated with Major Squier, in the latter's important experiments in wireless telegraphy. In 1904, Mr. Tinsley obtained the degree of Master of Science from Rutgers for professional work done since graduation and for a thesis on cables. He is a member of the Chi Phi and Phi Beta Kappa fraternities, an associate member of the American Institute of American Engineers, and an active member of the San Francisco branch of the Institute, which he helped to organize.

Trade Publications.

ARC LAMPS.—Supply catalogue No. 7591 of the General Electric Company, Schenectady, N. Y., describes parts of edgewise parallel-rod, 110-volt, direct-current multiple enclosed arc lamps, forms 12 and 14.

MINING MACHINERY.—The Allis-Chalmers Company, Milwaukee, Wis., has just issued bulletin No. 1403, describing the Hancock jig for use in concentrating plants. Bulletin No. 1404 deals with the McDougall roasting furnace of the enclosed firebox type.

THE SIMPLEX ELECTRICAL COMPANY, 110 State Street, Boston, Mass., has issued a limited edition of a little device in celluoid, serving as a wire computer. It is easy to carry in the pocket, and easy to apply in everyday work. On the back are sizes in B. & S. gauge and in circular mils.

TELEPHONES.—The Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y., has issued an attractive booklet describing its numerous types of telephones. Illustrations are given of intercommunicating desk telephones, combination hand telephones, portable desk telephones, central energy wall telephones, intercommunicating wall telephones and private branch exchange switchboards.

CRANES.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has issued an extremely well illustrated catalogue dealing with overhead-traveling, Gantry locomotive and ladle cranes for iron and steel works. These cranes are operated by electric motors. In addition to giving numerous views of installations now in service, the catalogue contains a list of the users of Wellman-Seaver-Morgan cranes, showing the number, the type and the capacity of the equipments.

PACKING AND GASKETS.—The Peerless Rubber Manufacturing Company, 16 Warren Street, New York, has issued an illustrated booklet describing "Rainbow" sheet packing, "Peerless" piston and valve-rod packing and "Eclipse" gaskets. A entertaining feature of the booklet resides in the use of numerous illustrations to emphasize the humorous remarks employed in calling attention to the several imitations of these standard goods which have appeared from time to time.

ELECTRIC RADIATOR.—Publication 3367, of the General Electric Company, Schenectady, N. Y., describes the luminous electric radiator. The source of the heat is a small filament which becomes incandescent immediately, emitting a powerful heat from the moment the current is turned on. The device radiates the heat and does not depend for its operation on setting up a current of warm air, which takes considerable time. The radiator is especially advantageous for giving temporary heat on chilly days, when it would not pay to start a fire in the house for the sake of warming one or two rooms.

MAKING TELEPHONE CABLES.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has just issued an instructive booklet giving an insight into the processes of manufacture of telephone cables. The booklet contains numerous illustrations showing the interior of the factory where the cables are produced. Views are also given of the laboratories for making mechanical, electrical and chemical tests. In issuing the pamphlet the company takes occasion to state that two years' experience in the manufacture of cable has necessitated the quadrupling of its plant to meet the increased demands.

REFLECTORS.—The new reflector manufactured by the National X-Ray Reflector Company, Chicago, is stated to be constructed on scientific principles, its power being due to the peculiar corrugations and flutings. The reflected rays, it is said, combine to produce a pure white light, with a resulting large economy. A 10-in. reflector utilizing a 16-cp lamp gives a useful illumination several times that from the lamp alone. It is claimed that these reflectors increase the illumination in a useful direction from a given number of lamps 100 per cent, and, conversely a given amount of illumination can be obtained from half the number of lamps usually employed.

MOTORS IN SMALL SIZES.—Booklet 4120 of the Emerson Electric Manufacturing Company, St. Louis, Mo., describes a line of self-starting, single-phase motors in sizes from .025 hp to 2.50 hp, and a line of fully enclosed, bipolar and multipolar motors in sizes from .05 hp to 2.50 hp. These motors are treated more in detail in the following bulletins: Bulletin No. 3201 treats of bipolar motors for direct current in sizes from ⅛ to ⅓ hp, while Bulletin No. 3202 deals with motors of a similar type in sizes from 1-20 to ⅙ hp. Bulletins No. 3301 and 3302 describe single-phase and direct-current motors, direct-connected to forge blowers and volume blowers respectively. The application of single-phase induction motors to the direct driving of laboratory lathes is discussed in Bulletin No. 3701.

ELECTRIC LIGHT SUPPLIES.—The H. T. Paiste Company, Arch and Thirty-Second Streets, Philadelphia, has recently issued Catalogue No. 12, covering electric light supplies. It contains a complete list, together with illustrations of Edison screw-base sockets and receptacles. There is shown also a new line of molding branch blocks, designed on the Fielding principle, so that they may be used anywhere along the line of molding without cutting it. Opposite each listed article is given a photograph illustration of the article itself, together with a statement concerning the average weight of standard packages of that article. It is believed that this table will prove of especial convenience in estimating costs. The book should prove of real and lasting value to the buyers and users of electric light supplies.

News of the Trade.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has opened a Boston office at Winthorp Square, 7 Otis Street. This office will be in charge of Mr. Frank Booth, who will represent both the Paiste Company and the New York Insulated Wire Company.

THE RUSSIAN OIL REGION.—The Earl of Ronaldshay's account of "A Visit to Baku," in *The Living Age* for November 4th, will give to many readers their first direct information regarding a region which has been the scene of some of the most tragic and sanguinary outbreaks of race and religious animosity during the last few months. These troubles have had a distinct effect on the conditions of American oil fields and oil markets.

FORT WAYNE ELECTRIC WORKS.—The Boston office of the Fort Wayne Electric Works, under the management of Mr. J. Allan Smith, has moved from its old home in 518 Exchange Building, into more commodious quarters at 110 State Street, Rooms 601-604 Plymouth Building. The old telephone number, Main 2044, is still retained. This change was necessitated by the large increase in business transacted by this office and the desire to handle it advantageously.

THE STANDARD VITRIFIED CONDUIT COMPANY, 39 Cortlandt Street, New York, will be among the exhibitors at the electrical show to be held in Madison Square Garden from Dec. 12 to 23. This company furnished all of the third rail insulators for the Interborough Rapid Transit Company for use both on the elevated and on the subway, and also supplied material for the Brooklyn Rapid Transit Company and the Scioto Valley Traction Company in Ohio.

THE AMERICAN ELECTRICAL NOVELTY & MANUFACTURING COMPANY has made arrangements with the Sarco Company, of New York, whereby it has taken the entire output of "Noscru" midget push buttons, and will hereafter be the sole selling agent of this device. On account of its numerous connections throughout the country, the American Electrical Novelty & Manufacturing Company will be able to make deliveries of push buttons in San Francisco as quickly as in New York.

KEYSTONE INSTRUMENTS.—The Keystone Electrical Instrument Company has arranged for representation in several different places in addition to the present agents and representatives. In Boston it is represented by F. B. Smith, 170 Summer Street, and in New York by Arthur Organ, at 114 Liberty Street. In Chicago it will be represented by William P. Crockett, 165 S. Canal Street; in St. Louis by S. M. Keeble, Seventh and Hickory Streets; in Philadelphia and territory adjacent thereto by Louis J. Costa, 1229 Real Estate Trust Building.

SOCIOLOGICAL REFORM.—After Nov. 1 *Charities* of New York, and *The Commons* of Chicago, will be merged. The combined weekly journal is a distinctly American idea—more or less of a co-operative undertaking among those who know conditions first hand and are shouldering such movements as housing and child labor reform, the prevention of tuberculosis, and the social utilization of public schools. The editorship will be in the hands of Edward T. Devine, of New York, and Graham Taylor, of Chicago. While neither periodical has hitherto gained a general circulation they have been read to a remarkable degree by editors, teachers, public officials, the executive officers of organizations, and others who get at public opinion of the community. To develop this educational work along national lines, a publication committee has been organized with Robert W. De Forest, former tenement house commissioner of New York, as chairman, and including Jane Addams and Margaret Dreier Robins, of Chicago; Jacob A. Riis, Frank Tucker and Robert S. Brewster, of New York; Daniel C. Gilman, Baltimore; Robert Treat Paine, Arthur F. Estabrook, Joseph Lee and John F. Moors, of Boston; Simon N. Patten, Philadelphia, and S. W. Woodward, Washington.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

AMERICAN ELECTRICAL SALESMEN ASSOCIATION. Secretary, Geo. H. Erich, 218 North Court Street, Rockford, Ill.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Sadtler, 39 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, B. V. Swenson, 114 Liberty St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. S. Barstow, 56 Pine St., New York City and Portland, Ore.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, George B. Tripp, Colorado Springs, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, F. Fish, Rochester, N. Y. Next meeting, Buffalo, Jan. 16, 1906.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, J. A. Mann, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Annual meeting, second Thursday in January, 1906. Monthly meetings, second Thursday of each month.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, P. E. Bellamy, Knoxville, Ill. Next meeting, Des Moines.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, second Tuesday in March, 1906.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION.. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Detroit, Oct. 10, 1905.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Frank S. Leach, Sedalia, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 1142 Wells Building, Milwaukee, Wis. Next meeting, Milwaukee, Wis., third Wednesday in January, 1906.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, C. J. Miller, 620 Shorb Street, Canton, Ohio. Next meeting, Canton, O., Nov. 17 and 18, 1905.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass. Annual meeting of Electrical Committee, 32 Nassau Street, New York, Dec. 6, 1905.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

WESTERN SOCIETY OF ENGINEERS, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 24, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys, 140 Nassau St., N. Y.]

802,369. CIRCUIT CONTROLLER OR ELECTRIC SWITCH; John P. Coleman, Edgewood, Pa. App. filed Apr. 1, 1904. The longitudinal controller shaft is square and has a sleeve slidable thereon carrying the contact arms. The sleeve is held against longitudinal movement by its bearings, so that oscillatory movements of the shaft control one set of contacts, while longitudinal movements of the shaft are transmitted to another set. The device is so arranged as to prevent oscillatory movements of the shaft after a longitudinal movement.

802,370. ILLUMINATING APPARATUS; Paul E. Collins, Boston, Mass. App. filed Aug. 29, 1904. Various groups of incandescent lamps forming the letters are switched into and out of circuit by controllers which are operated by thermostats. In this way an intermittent illumination of the several groups is secured without clock work or other continuously running mechanism.

802,373. MAGNETO DYNAMO ELECTRIC MACHINE; Elisha B. Cutten, Butte, Mont. App. filed May 29, 1903. A magneto machine for producing jump sparks having an armature wound with primary and secondary coils. The primary circuit is broken by a specially arranged commutator so as to divide the spark among a plurality of points.

802,387. TELEPHONE CUT-OUT AND SWITCH; Owen M. Galloway, Edward B. White and Adam D. Neptune, Mountayr, Ia. App. filed Sept. 1, 1904.

802,397. INSULATOR FOR ELECTRIC WIRES; Clarence A. Humphrey, Elyria, O. App. filed Feb. 15, 1904. A screw-threaded vertical stud has a notch or recess therein into which a wire is clamped by means of insulating blocks, and a nut which screws on to said threaded stud.

802,413. ELECTRICAL APPARATUS; James E. Seeley, Los Angeles, Cal. App. filed July 20, 1904. A large electro-magnet is provided for generatin impulses by self-inductive action which are received by a condenser. An auxiliary discharging circuit for the condenser contains a spark gap and the primary of an air transformer. When the condenser discharges across the spark gap the air transformer is effective to produce a jump spark for ignition purposes.

802,417. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Feb. 23, 1904.

802,418. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Nov. 25, 1903.

802,419. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Jan. 15, 1904.

802,420. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Aug. 17, 1905.

802,421. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Mar. 31, 1905.

802,422. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Apr. 29, 1905.

802,423. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Apr. 29, 1905.

802,424. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed May 4, 1905.

802,425. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed May 4, 1905.

802,426. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed May 10, 1905.

802,427. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed June 20, 1905.

802,428. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed June 24, 1905.

802,429. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed June 24, 1905.

802,430. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed June 24, 1905.

802,431. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed June 29, 1905.

802,432. SPACE TELEGRAPHY; John Stone Stone, Cambridge, Mass. App. filed Dec. 16, 1904. Patents 802,417 to 802,432, inclusive, will be reviewed in a subsequent issue.

802,437. BELL RINGING APPARATUS; Friedrich Weuls, Eockenem, Germany. App. filed Apr. 2, 1903. A continuously operating motor is geared to an intermittently moving part which has spring connections to the bell hammer so as to impart a regular and gradual movement thereto for ringing the bell.

802,451. ELECTRIC MOTOR; Dugald C. Jackson, Chicago, Ill. App. filed Mar. 8, 1900. (See Current News and Notes.)

802,452. INDUCTION-MOTOR DEVICE; Dugald C. Jackson, Chicago, Ill. App. filed Mar. 8, 1900. (See Current News and Notes.)

802,463. RAIL BOND; George A Mead and Charles R. Sturdevant, Mansfield, O. App. filed Dec. 22, 1904. A rail bond adapted to be soldered to the upper side faces of the rail. The parts to be soldered are of wedge-shaped or tapered form so as to merge into the surface of the rail.

802,480. ELECTRIC INTERRUPTER OR VIBRATOR; James E. Seeley, Los Angeles, Cal. App. filed Feb. 1, 1905. A mounting for an induction coil vibrator comprising a tensile strip from which the vibrator pro-

jects in the form of a lateral arm. The periodicity is adjusted by varying the tension of said strip.

802,485. RAILWAY SIGNAL SYSTEM; Charles W. Stiff and Claude L. McKesson, Colorado Springs, Colo. App. filed Dec. 1, 1904. A mechanical tappet for railroad signal systems comprising a ratchet wheel in a box upon the railroad ties, and a projection which steps it around for making different circuits by contact with the engine wheels.

802,497. GROUND STRIP FOR PROTECTIVE APPARATUS; Frank B. Cook, Chicago, Ill. App. filed Aug. 5, 1904. Comprises a metallic frame having studs thereon between which the lightning arresters are held in place. The lightning arresters comprise spaced carbon blocks which are held against the frame by spring clips which also form the connections from the circuit to be protected.

802,498. RETAINING CLIP FOR THIRD RAIL INSULATORS; William Courtenay, New York, N. Y. App. filed Dec. 6, 1904. An insulating base or support has transverse holes therethrough, each of which contains a pair of opposed hooks which are secured to one another and serve to clamp the rail.

802,539. TROLLEY FOR ELECTRC CARS; George F. Warburton, Denver, Colo. App. filed Aug. 6, 1904. An auxiliary trolley pole is connected to the usual pole by spring means, and is designed to prevent breaking the motor circuits even in case the main trolley leaves the wire.

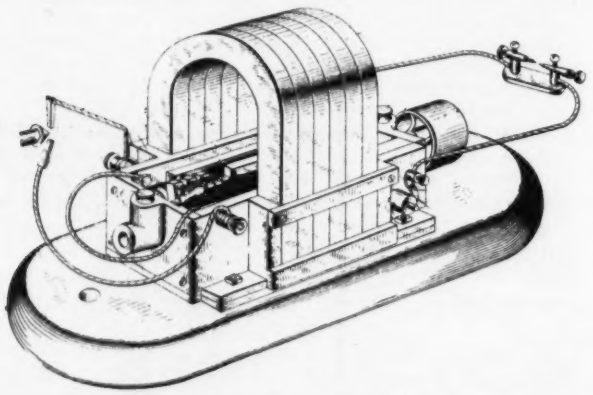
802,553. PLUG FUSE BOARD; William F. Bossert, Utica, N. Y. App. filed Feb. 14, 1905. In order to obtain a cheaper construction of panel board, and to secure better conductors thereon, the fuse plug sockets are made of stamped and drawn copper plate rather than brass castings of the form usually employed. The threaded shell receiving portion is made by flanging the edges of a hole through the copper plate and then threading such flanges.

802,554. AUTOMATIC FIRE ALARM SYSTEM; George B. Bowell, London, Eng. App. filed Dec. 31, 1903. A fire alarm signal transmitter in which the opening of the alarm circuit causes clock work to transmit the alarm impulses in the usual way. A shunt relay within the apparatus is effective to transmit a different signal in case the wires within the apparatus become disconnected from the signal transmitted in case of a fire.

802,573. ALARM SYSTEM; John M. Latimer, Philadelphia, Pa. App. filed Sept. 11, 1902. Two parallel leads run from the signal transmitter throughout the building, and are connectable at various points by thermostats for closing the alarm circuit. Each one of the leads has connections at both ends for forming a separate test circuit which is constantly closed, and insures the continuity of the leads.

802,577. CONDUIT FOR ELECTRIC WIRES; Robert W. Lyle, New York, N. Y. App. filed Feb. 10, 1903. In conduits of the form where dovetailed grooves are provided in the side walls for the reception of metallic dowel pins, the grooves have terminal walls which are integral with the conduit.

802,583. ELECTRIC RAILWAY SIGNAL; Elwood W. McGuire, Richmond, Va. App. filed Mar. 6, 1905. At the different turn-outs conductors are



802,373.—Magneto Dynamo Electric Machine.

placed between the track rails so that a car standing on the turn-out completes certain signal circuits which cause signals within the car.

802,584. ELECTRIC RAILWAY SIGNAL; Elwood W. McGuire, Richmond, Va. App. filed Mar. 30, 1905. Oppositely toothed ratchet wheels are respectively stepped around by the entrance or exit of a car from the single track section, so that a contactor arm makes a signal circuit as long as cars are present thereon. Conductors are arranged at the turnouts to complete circuits with the cars standing thereon to which the signals are thus transmitted.

802,597. SELECTIVE SIGNALING APPARATUS; Egbert A. Reynolds, New York, N. Y. App. filed Aug. 19, 1904.

802,619. SYSTEM OF ELECTRICAL DISTRIBUTION; John H. Anderton, Boston, Mass. App. filed Feb. 28, 1905. In order to show when an induction motor driving a continuous current dynamo may be safely connected with an alternating circuit, the patentee provides means for transforming the direct current which is used for starting, into an alternating current synchronous with the phase of the motor, and employs the usual incandescent lamp phase indicator so as to know when the motor is in condition to be thrown on to the alternating current mains.

802,620. METHOD OF TREATING SOLID MATERIALS; Kristian Birkeland and Samuel Eyde, Christiania, Norway. App. filed Sept. 1, 1904.

802,632. SELF-PROPELLED VEHICLE; Edwin R. Gill, New York, N. Y. App. filed Jan. 2, 1901. The wheel of an electric automobile is in itself constructed with a complete very flat electric motor built therein. The purpose is to do away with power transmitting devices, and particularly to permit the power-driven wheels as well as the idle wheels to be deflected in the act of steering.

802,644. TELEPHONE DESK SET; William Kaisling, Chicago, Ill. App. filed Nov. 23, 1903.

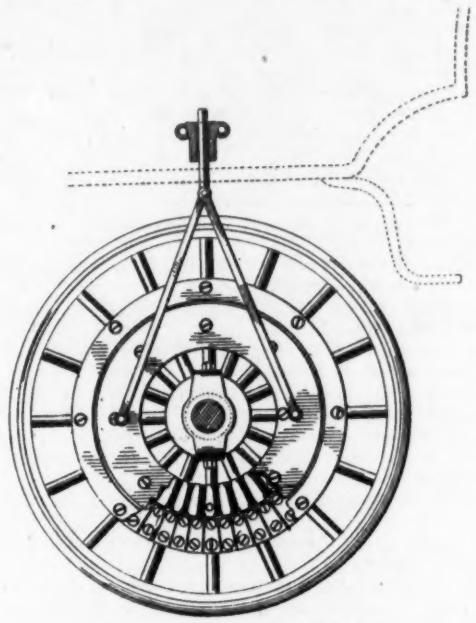
802,671. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Feb. 14, 1903.

802,675. ELECTRIC BELL; Charles E. Avery, Jersey City, N. J. App. filed Mar. 16, 1904. An ordinary bell has an electro-magnet axially arranged therein which operates a pivoted bell clapper. The supporting hook for the bell is so arranged as to make both electrical connections whenever the bell is hung thereon.

802,676. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS ALONG RAILWAYS; William A. Bartley, New York, N. Y. App. filed Feb. 24, 1905. Means for enforcing a caution signal in case the speed of a train is too high, employing train stops which are made effective in case the time of passage of the train through a block section is too small.

802,684. HEAT COIL; Frank B. Cook, Chicago, Ill. App. filed Apr. 8, 1905. The heat coil is wound on a metallic core which has a cap soldered to one end thereof. When the core is heated, the cap melts off and permits two spring blades to separate and break the circuit to be protected.

802,697. CIRCUIT CONTROLLING DEVICE; Harry T. Johnson, Jersey City, N. J. App. filed Apr. 2, 1904. A form of burglar alarm having a spring pressed plug projecting through the floor which is normally held against circuit closing movement by the chairs and other furniture of the



802,632.—Self-Propelled Vehicle.

room. When the chairs are moved the plug springs up and makes the alarm circuit.

802,702. POLARITY INDICATOR; Frederick W. Manger and Charles E. Avery, Jersey City, N. J. App. filed Mar. 24, 1904. A glass tube contains a pair of electrodes immersed in liquid which changes color when the current passes therethrough. The polarity is indicated by the change of color at the negative pole.

802,707. APPARATUS FOR PIERCING METAL; Frank M. Peters, Chicago, Ill. App. filed Mar. 15, 1902. An apparatus for piercing armor plates or steel billets, employing a conducting tube having a carbon rim which is pressed against the metal. A circuit is formed between the tube and the metal to be pierced so that the heat generated at the point of contact melts the metal and allows the tube to pass therethrough.

802,716. PROTECTED RAIL; Louis Steinberger, New York, N. Y. App. filed Nov. 2, 1904. A third rail formed of a metal strip bent into an inverted U-shaped form. The rail is grasped by insulators at one of its edges and has an insulating coating on its exterior surface for protection.

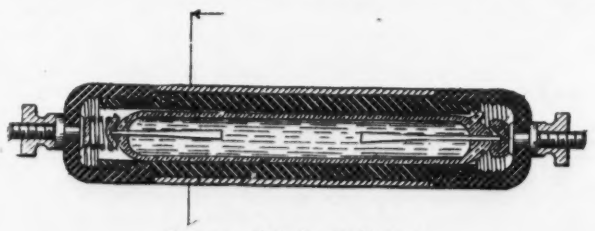
802,736. ELECTRIC FUSE; Frank B. Cook, Chicago, Ill. App. filed July 9, 1904. Means for supporting an ordinary fuse tube upon a panel board without screws or clamp nuts, comprises spring clips having transverse openings into which the ends of the fuse are inserted. When the fuse tubes are bent down into position the spring resistance causes an efficient clamping contact.

802,749. ELECTRIC SIGNAL FOR RAILWAYS; Frederick H. Gray, Leavenworth, Kan. App. filed Mar. 7, 1905. The trolley wire is made with insulated sections at intervals and connections therefrom operate relay magnets for the signal circuits under the influence of the motor current as the car passes the successive sections.

802,753. ELECTRIC BELL RINGER; Ira W. Hall, Brownwood, Tex. App. filed Mar. 21, 1904. An electro-magnetic trip serves to release a weight which falls slowly, and simultaneously starts a bell-ringing mechanism into operation. After the weight falls a predetermined distance it contacts with a lever which serves as a stop motion to prevent further ringing of the bell.

802,875. FIRE PROTECTION SIGNAL SYSTEM; James G. Nolen and John E. Shepherd, Chicago, Ill. App. filed Mar. 20, 1905. A device for indicating changes of pressure in sprinkler mains, etc., comprising an ordinary steam gauge tube with a lever attached thereto which makes and breaks a circuit at a mercury cup under the expanding and contracting movements of the tube.

802,896. ELECTRIC LOCK; Nicholas W. Webb, New York, N. Y. App. filed Nov. 1, 1904. In addition to the usual bolt a supplemental bolt is provided which is normally ineffective. When, however, a person tampers



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with a lock and attempts to force it, the supplemental bolt is thrown which rings an alarm circuit.

802,939. GROUND PLATE FOR ELECTRIC PROTECTIVE APPARATUS; Frederick R. Parker, Chicago, Ill. App. filed Nov. 26, 1904. A combined thermal protector and lightning arrester employing a ground plate having studs which position the lightning arresters, and spring contacts which hold the lightning arresters in place and also constitute supports for the thermal protectors.

802,941. PROCESS FOR THE REDUCTION OF METALLIC OXIDES AND THE SEPARATION OF THE RESULTING METALS; Auguste J. Rossi, New York, N. Y. App. filed Nov. 3, 1902.

802,960. ELECTROLYTIC APPARATUS; Frank J. Briggs, Everett, Mass. App. filed Jan. 19, 1905.